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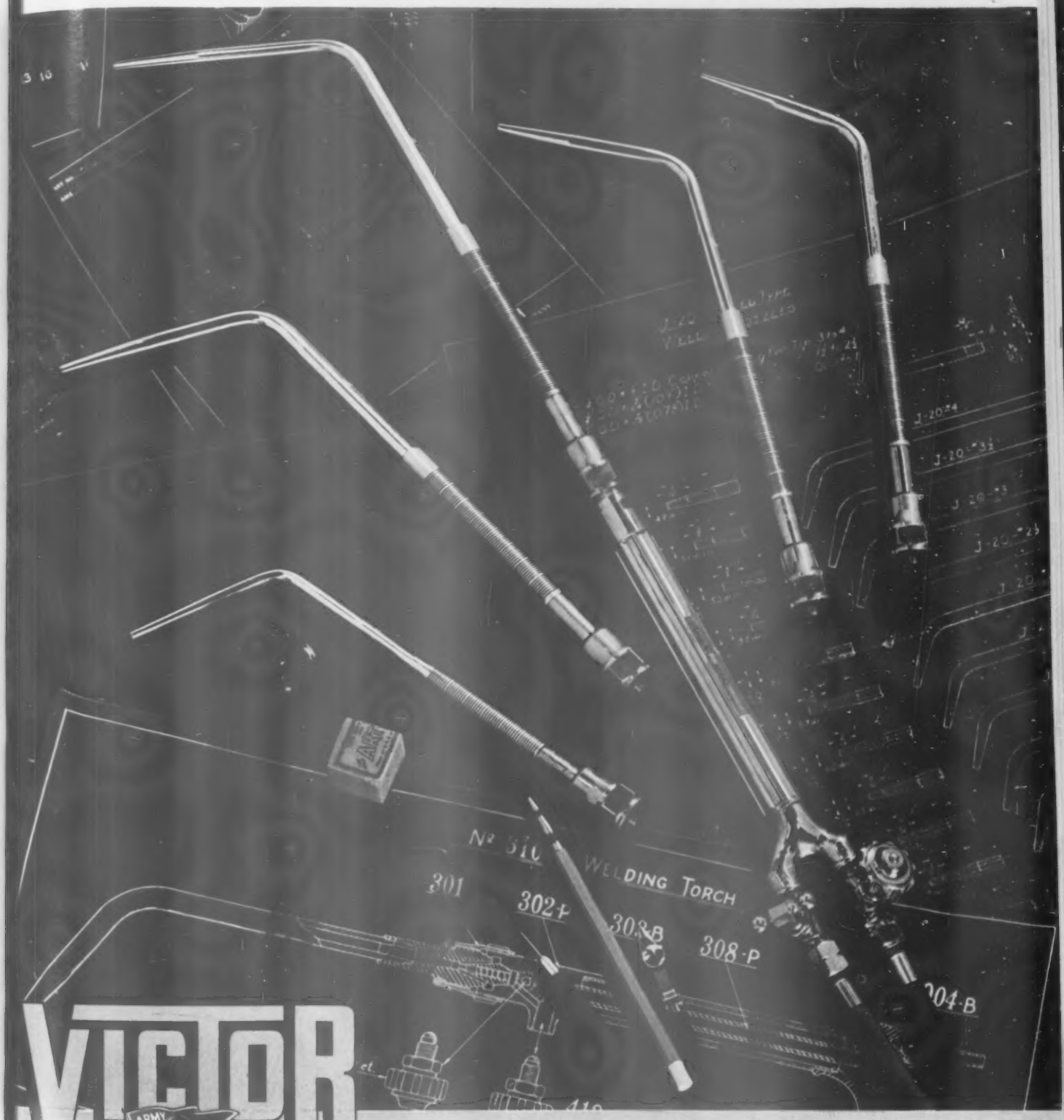
PIONEER BUSINESS AND TECHNICAL JOURNAL OF THE WELDING INDUSTRY



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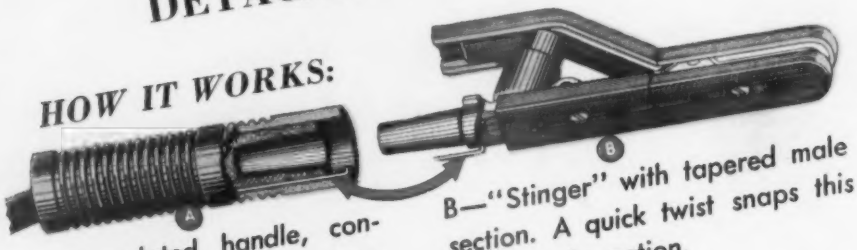

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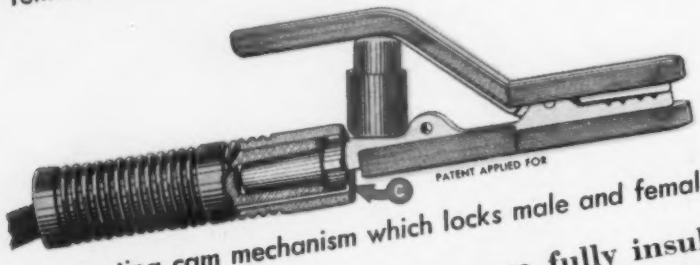

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The Welding Engineer

Vol. XXVIII, No. 11 NOVEMBER, 1943

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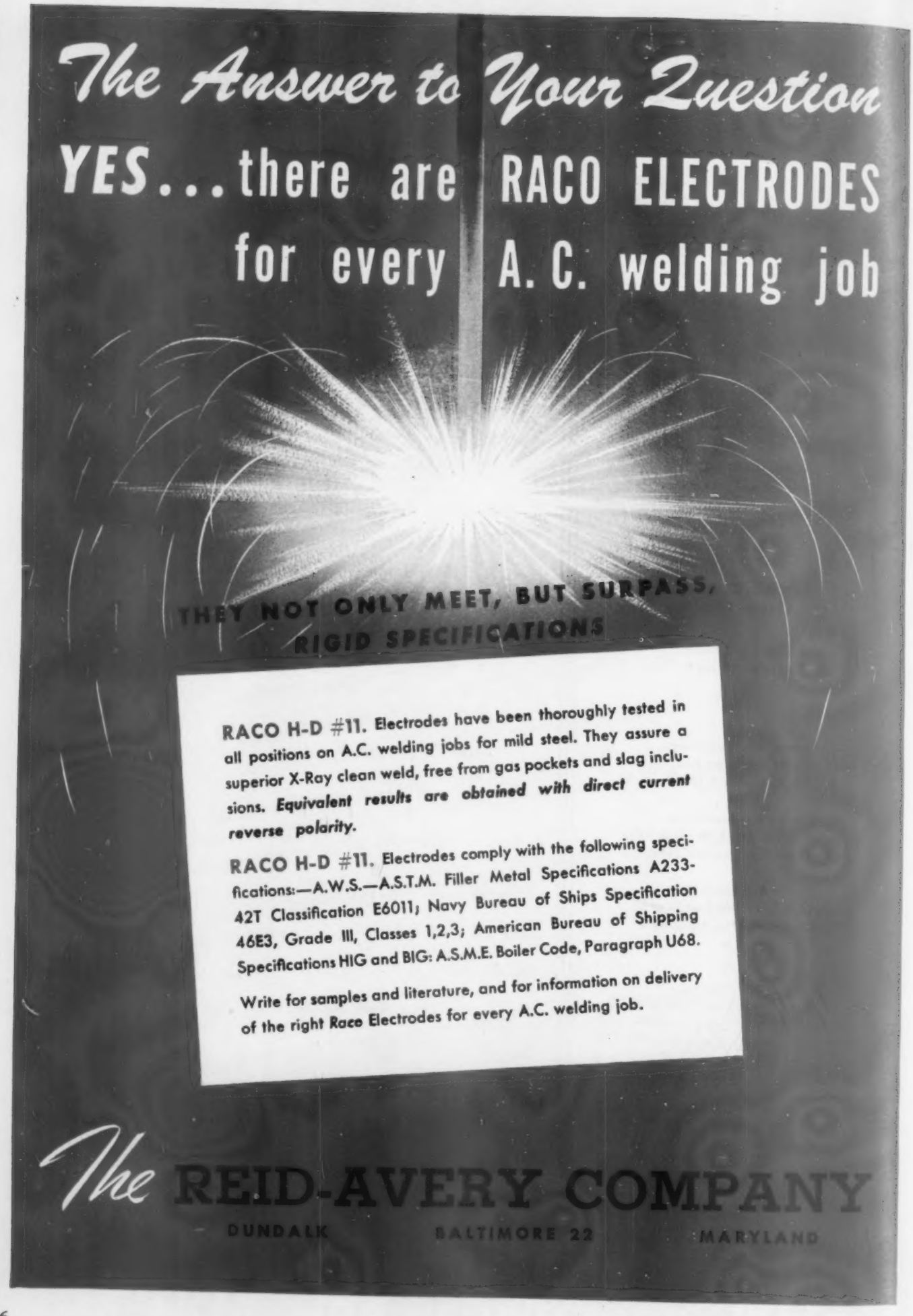

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The Welding Engineer

AMERICA'S PIONEER WELDING JOURNAL

Established 1916

Not Without Sin.....

Management complains of the absentee employee, but is management itself wholly without sin? We don't think so.

In the past, the sins of management caused numerous labor difficulties. Many managements thereupon reformed. Some, however, missed the "day of reckoning" and are continuing at full speed with their old sinful ways. The fallacy will be discovered later—let us hope that it will not then be too late.

Some sins of management may best be discussed by citing from a letter we received in answer to our recent discussion on absenteeism. (See page 29, September issue, THE WELDING ENGINEER.)

"I am an oxy-acetylene and arc weldor with four years' experience. I selected welding because of its appeal to me as a trade. A very great many of the nation's weldors went into welding because of what they thought to be attractive pay. Many are satisfied just to draw an arc or to light a torch and have no wish to learn or study more. These men will be washed out after the war, and this is the only encouraging thing about them.

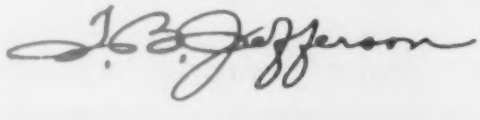
"There is, however, another problem which is also a great hindrance to a fuller war production effort. Even before Pearl Harbor, I volunteered as an air raid warden, blood donor, Red Cross collector, Minute Man and so on. At the same time, I put all my effort into my work. To my greatest disappointment, I did not find any response on the part of the two employers for whom I did war work.

"At the first job (after two years of peacetime work), I was put in charge of a newly created arc welding department. Here I tried to convey to my men the idea given to me by my employer; namely, that the department was a 'bottleneck' and our production was 'sorely needed' to permit ships to leave port. I worked as hard or harder than I asked my men to work. I even earned the title 'slave-driver,' of which I am justly proud because it shows I did my duty. When production was upped, my reward was to be told that no supervisor was needed so I could now take my old place among the other weldors. Our production went down 25%, but this did not seem to matter; later on I found out that the 'sorely needed' product had been stored up to the ceiling.

"In disgust, I went to a new job. There my new employer called a meeting of all his employees and urged us to increase production by 25% to 40% because of the same reasons as have been mentioned before. The response was good. During the following two months, output was materially increased. The results were: (*a*) a weldor who left was not replaced, (*b*) our working time was reduced from 52 to 48 hours and (*c*) work has been given to an outside contractor who pays his weldors less but requires a longer time to do the job."

The moral, we think, is obvious. The shortsighted greed of these two employers has killed much of this man's incentive—a sin against mankind! If there is anything that is sure to slow up war production and to promote absenteeism, it is the stifling of personal initiative—whether by labor, by management, by Government or by the combined efforts of all three.

So that the sun may again be allowed to shine on a free world, incentive, initiative and enterprise must be encouraged in every way possible.



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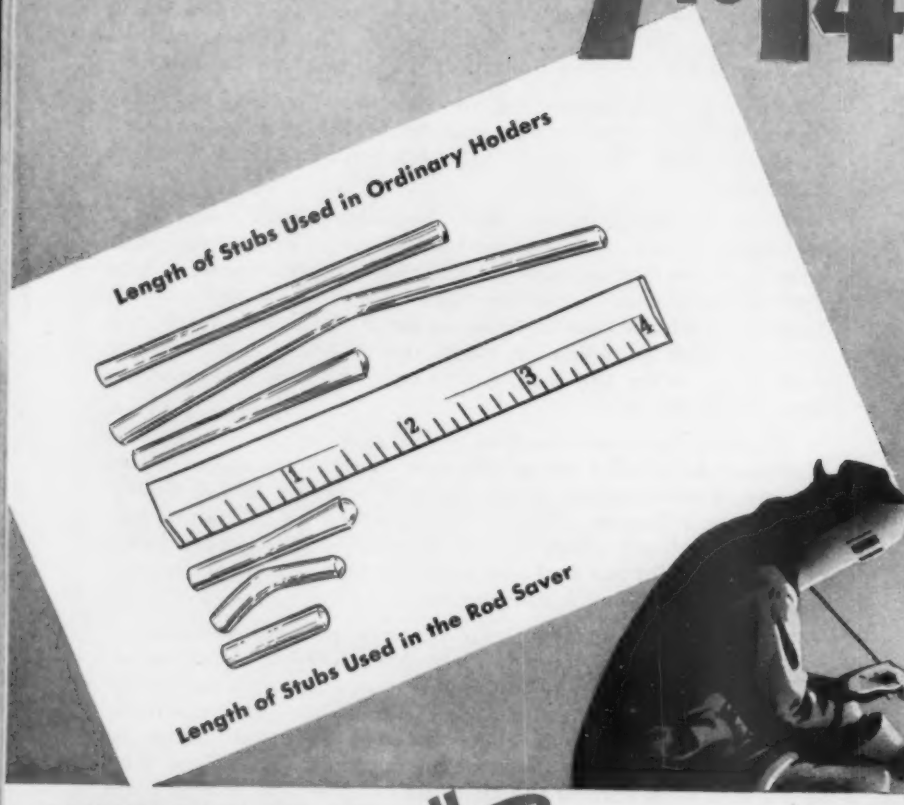

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Twenty-fourth AWS Meeting

Questions answered by experts from the floor resulted in the solution of many vexing war production problems and helped to make the Welding Society's recent annual meeting "the best ever." Over 1,500 visitors attended.

THE 24th annual AWS meeting, held at the Morrison Hotel, Chicago, from October 18 to 21, was described by many in attendance as "the most successful meeting ever staged by the American Welding Society." At least, there has been set an example illustrating what may be accomplished from a gathering of welding engineers, supervisors, welders and other interested individuals earnestly seeking knowledge on welding.

Metal Congress

Simultaneously, the 25th National Metal Congress and War Production Display was held at the Palmer House. The Metal Congress, occupying three floors, provided space for 225 exhibitors. Even though attendance was not as large as it has been in the past, some 20,000 persons interested in the metal working trades registered from all parts of the United States, from Canada, from Latin America and even from England.

The Metal Congress (in reality it consisted primarily of displays) was different from any of the past. This meeting was planned and built to meet the year's prevalent need for information regarding metal problems relating to war production. The overwhelming attendance at the various war production conferences was indicative of the need for just such an event.

More at AWS Meeting

Altogether, 1503 registrants attended the AWS annual meeting, the registration being even greater than last year's. The meeting was a streamlined affair lasting four days; some 63 papers and an inspection symposium provided the program at its 20 technical sessions. There were also sessions for the presentation of the awards, the annual business meeting and many committee meetings dealing with industrial research, fundamental research, War Production Board activities, etc. The general verdict of those in attendance seemed to be that the meetings were of high caliber. Furthermore, everyone seemed to be getting more good out of the meetings than in the past—perhaps because the delegates to this year's convention came with questions and problems to which they were desirous of obtaining answers.

In some instances, the above trend was carried so far that the technical sessions became "problem clinics." Many interesting questions came from the floor, bringing out points that authors had failed to cover in their various papers. As a result of these discussions, a good many registrants were enabled to obtain satisfactory solutions to problems arising from the increased use of welding in war production work.

Miller Award to Jacobus

The opening session of the 24th annual meeting featured the presentation of awards. The 1942 Samuel Wylie Miller Memorial Award was presented to Dr. David S. Jacobus, retired consulting engineer of the Babcock and Wilcox Co., Barberton, Ohio, for the "most conspicuous contribution to research standardization and advancement of welding construction." Dr. Jacobus has long been known for his work in welding. He was president of the American Welding Society in 1934-35 and was awarded the 1935 Morehead Medal by the International Acetylene Association for his leadership in formulating codes and procedures.

It was largely the persistent efforts of Dr. Jacobus, as a member and chairman of the ASME Boiler Code Committee, that brought about the present enthusiastic acceptance of welding as a means of joining pressure vessels. This has great importance today inasmuch as many modern industrial accomplishments depend on heavy pressure vessels which could not be constructed were it not for fusion welding. Dr. Jacobus has also received the National Association of Manufacturers' Award as a "Modern Pioneer" of American industry.

Lincoln Medal to Lehigh Group

The Lincoln Gold Medal, donated to the American Welding Society by James F. Lincoln, president, Lincoln Electric Co., Cleveland, was awarded to Gilbert E. Doan, professor of

New officers elected by the American Welding Society for 1943-44 are: David Arnott (top), American Bureau of Shipping, New York City, president; Isaac Harter (center), vice-president, Babcock & Wilcox Co., Barberton, O., first vice-president, and A. C. Weigel (bottom), vice-president, Combustion Engineering Co., New York, second vice-president.

metallurgy of the Department of Metallurgy, Robert B. Stout, instructor in metallurgy, and John H. Frye, Jr., associate professor of metallurgy —all of Lehigh University, Bethlehem, Pa. The award is presented each year for the paper judged to be the greatest contribution to the advance and use of welding. This year's award was made on a co-authored paper entitled "Preserving Ductility in Welds" which was presented at the session on weldability held Monday afternoon. This paper was published in the July, 1943, issue of *The Welding Journal.*

The awards made by the Resistance Welder Manufacturers' Association included:

The university prize of $100. This was awarded to W. F. Hess, assistant professor of metallurgy and head of the welding laboratory, and to D. C. Herrschaft, both of Rensselaer Polytechnic Institute, Troy, N. Y. The award was made for the paper entitled "Spot Welding of 0.040 in. SAE X-4130 Steel" that was given at last year's meeting.

The industrial group prize of $100 was awarded for the paper entitled "The Effect of Weld Spacing on the Strength of Spot Welded Joints" by Richard Della-Vedowa, production research department, and Mabel Rockwell, production research engineer in charge of research and development, both of Lockheed Aircraft Corp., Burbank, Calif. Honorable mention went to: F. B. Hensel, metallurgical consultant, E. I. Larsen, research engineer, and E. F. Holt, senior research engineer, all of P. R. Mallory and Co., Indianapolis. They co-authored a paper entitled "Refrigerant-Cooled Spot Welding Electrodes."

The Adams Lecture

The first Adams Lecture followed the presentation of awards at the Monday morning session. By unanimous vote of the board of directors, this lectureship was established in honor of the Society's first president as a special feature of the annual meetings. The lecture is to cover some

Dr. David S. Jacobus, recipient of the Samuel Wylie Miller Memorial Award.

phase of the science of welding and is to be given by an outstanding authority within his field, who will be selected by the Committee of Awards with the approval of the board of directors.

For the first Adams lecture, the Committee on Awards had recommended Dr. C. A. Adams, in whose honor the lectureship was established. Dr. Adams detailed some important work done in connection with the quantitative analysis of the electrical and thermal factors involved in resistance welding. This study puts heat flow on a definite basis with respect to both the steady flow and transient conditions. Much of the data discussed has been made available in the form of charts and curves which now make it possible to calculate and predict heat flow in resistance welding.

In this highly technical illustrated lecture, a warning was given against the two extremes of heat flow: insufficient input, which never forms a weld, and excessively rapid input, which makes a weld too rapidly and thus causes problems of control. With the aid of graphs, however, it is now possible to determine the optimum welding condition.

On recommendation of the Committee of Awards, Dr. A. B. Kinzel, director of research, Union Carbide and Carbon Corp., has been selected as the 1944 lecturer.

Larger Membership

The meeting was closed on Thursday afternoon, October 21, with the Society's annual business meeting, at which the various officers gave reports of their year's activities. It is indeed gratifying to learn that during the past year the Society's membership has increased 31% so that it now includes 6,661 members on its membership roll. Six new sections were formed during the year while two more are in the organization stage, indicating the effective work done by the National Membership Committee. In all, there are now 45 local sections of the Society.

Among the important changes made in the laws of the Society was the installation of operator members in the Associate Membership Classification. In the future, all operators

Other award winners. Left to right: Richard Della-Vedowa, Mabel Rockwell, W. F. Hess and Gilbert E. Doan. Mr. Della-Vedowa, Miss Rockwell and Dr. Hess were recipients of Resistance Welder Manufacturers' Association prizes. Dr. Doan was one of the co-authors of the paper which won the Lincoln Gold Medal Award.

will be included as associate members and pay annual dues of $10.

New AWS Officers

The meeting was brought to a close by the installation of the new officers and the award of the retiring president emblem to K. L. Hansen. David Arnott, vice-president and chief surveyor, American Bureau of Shipping, New York City, is the Society's new president. First vice-president is Isaac Harter, vice-president, Babcock and Wilcox Co., Barberton, O; second vice-president is A. C. Weigel, vice-president, Combustion Engineering Co., Inc., New York City.

Directors at large are: H. W. Pierce, assistant to general manager, New York Shipbuilding Corp., Camden, N. J.; E. R. Seabloom, supervising engineer, research and development laboratories, Crane Co., Chicago; K. V. King, materials engineer, Standard Oil Co., San Francisco; and J. H. Deppeler, chief engineer, Metal and Thermit Corp., New York City.

Five district vice-presidents were also elected. They are: F. C. Fyke, head, materials division, general engineering department, Standard Oil Development Co., Elizabeth, N. J., for New York and New England; C. H. Jennings, section engineer, welding section, Westinghouse Electric and Mfg. Co., E. Pittsburgh, Pa., for middle eastern region; G. N. Sieger, president and general manager, S-M-S Corp., Detroit, for the midwest; E. C. Chapman, metallurgist in charge of welding research, Hedges-Walsh-Weidner Div., Combustion Engineering Co., Chattanooga, Tenn., for the southern district, and J. C. Gowing, Southern California representative, Hobart Bros., Los Angeles, for the Pacific coast.

Inasmuch as the National Metal Congress will be held October 16-20, 1944, in Cleveland, the next annual meeting of the American Welding Society will probably be held in that city in the same week.

★ ★ ★

IAA Luncheon Meeting

THE International Acetylene Association held its 43rd annual business meeting at the Palmer House on October 20th. This meeting started with a noon luncheon and lasted only until 2 o'clock.

The business activities of the meeting were opened with a brief address by President Ellsworth L. Mills, who outlined the important part that the International Acetylene Association has played in the welding industry during the 45 years of its existence. "When the history of this war is written," he said, "the epic accomplishments on the production front will be listed among our major victories. And those of us in the industry here represented can take justified pride in the fact that the oxy-acetylene flame helped to cut open the floodgates of production."

Postwar Economics

Mr. Mills' opening address was followed by a talk by E. Graham Hutton, director of the Chicago office of the British Information Service. Mr. Hutton's address on "The Economics of the Postwar World" has been interpreted by various individuals in different ways. One such interpretation is that the statistics and figures presented demonstrated the need for postwar cooperation between British and American interests. Mr. Hutton made a gloomy prediction of future wars unless satisfactory cooperation between the two great Anglo-Saxon powers can be achieved.

David Arnott, new president of the American Welding Society, gave a brief but entertaining talk on the part welding has played in our shipbuilding industries.

Secretary H. F. Reinhard's report outlined the activities of the Association during the past year. Particular emphasis was placed upon the publications issued to members—"Air Raid Protection of Oxy-Acetylene Equipment and Installations," "Flames of Production" and the Department of Labor publication, "Advisory Standards for Welding Occupations."

The members were advised that the International Acetylene Association has gone on record along with other interested organizations in requesting the American Standards Association to undertake the preparation of a welding safety code. The ASA has approved this project and has appointed a committee, which has already had several meetings. Secretary Reinhard is the IAA representative on this committee.

Officers and Directors

The Association by-laws were amended to provide for the increase of the executive committee from three to four members. In the directors' meeting which followed, Henry Booth was elected as the fourth member of the executive committee.

By unanimous vote, the IAA officers and directors of the previous year were retained for the coming year. These officers are: Ellsworth L. Mills, The Bastian-Blessing Co., Chicago, president; Glenn O. Carter, The Linde Air Products Co., New York City, vice-president; H. F. Reinhard, secretary; Philip Kearny, treasurer. The executive committee now consists of H. S. Smith, chairman, Philip Kearny, C. D'W. Gibson and Henry Booth.

Ellsworth L. Mills, who has been re-elected president of IAA.

Henry Booth, new member of executive committee.

AWS Papers in Digest Form

A variety of technical papers was presented at the 24th annual meeting of the Welding Society. Some of the more important of the 63 papers which were given at Chicago have been abstracted for this summary.

Electronic Control of Gas Cutting Machines

By R. D. McComb

Industrial Control Division, General Electric Co.

THIS PAPER presented in non-electronic language an explanation of how the new photo-electric template control operates to control the movement of a gas-cutting machine. The gas-cutting machine is equipped with the standard head which is normally used in conjunction with a paper template. In normal operation, the operator controls the machine by hand so that the driving wheel follows the template around the work.

The electronic control is added to this machine in several steps. The paper first explained operation of the steering motor and the manner in which it operates. To this assembly is added a lens tube which is also driven by the steering motor. The optical system is added to this lens tube.

The operation of the control was described as the machine follows a straight line, a curved line, and sharp corners, and an explanation was given of the operation of the electronic control circuit which controls the steering motor in response to the signal from the scanning head.

» «

Machine-Cutting for Assembly Line Fabrication

By C. O. Adams

Welding Engineer, Delco Products, Division of General Motors

THE PURPOSE of this paper was to present some applications of machine-cutting to assembly line fabrication of generator parts for Diesel-electric units required in the war effort. It first covered the requirements of cutting machines for assembly line operation and the general methods of operation and layout. Then followed a discussion of tooling, processing, and production problems involved in the shape cutting, edge preparation and scheduling of flame-cut parts.

Mr. Adams stated that the cutting machines available today satisfy the consistent, repetitive operation required for the use in line assembly methods of fabrication. The use of automatic tracing devices, templates, fixtures and job-setters responsible for machine operation permits productive operations with relatively unskilled operators, thus assisting the war manpower problem. However, a careful scheduling of cutting operations is necessary in order to maintain efficient and smooth fabrication line operation. Factors such as floor plan layout, handling equipment, set-up time and incoming material schedules must be balanced and weighed carefully in preparing the cutting schedules, since these schedules control the assembly line.

Careful scheduling will avoid delay and down time due to set-up changes and material flow. The same care and attention normally applied to machine tool operations are required to maintain efficiency in an assembly line involving machine-cutting.

Flame-Cutting Heavy Sections

By R. L. Deily *and* E. Benyo

Bethlehem Steel Co.

TODAY'S wartime needs for fast delivery of heavy steel sections made it mandatory to flame-cut sections of almost unlimited thicknesses. Therefore, new technique and equipment were developed to accommodate torch cutting of massive forged steel sections up to 42 in. thick without the aid of a lance. Flame-cutting is said to be "heavy" starting with sections upwards of 20 in.

For heavy cutting, the technique employed is essentially the same as for lighter work; the most difficult part is in starting. It is very important to allow sufficient time for flame preheat. The high pressure oxygen valve is then opened and the forward motion of the torch started a fraction of a second later, gradually increasing this motion to full cutting speed. With these operations properly timed, the cut progresses down the face of the piece at a constant rate and without a sharp shelf forming at any point until it breaks through the bottom.

This paper discussed various special kinds of shape-cutting and single purpose machines, along with some outstanding heavy cutting jobs. Two three-dimensional profiling operations were discussed, one of which entailed cutting a 14 in. diameter hole in 36 in. thickness. A highlight was the description of cutting five-throw crank-shafts from slabs 10 ft. wide by 25 ft. long, 25 in. thick in the main body with thicknesses of 42 in. on the flange end. A cut through 51 in. of an alloy ingot was also described.

» «

Welded Locomotive Boiler

By E. G. Young

University of Illinois

FROM THE standpoint of the designer, the railway world was ready for the all-welded locomotive boiler about 30 years ago, as soon as weight-limiting specifications began to crowd against the engineer's desire to apply the largest capacity boiler which could be used. But the welding art and the Interstate Commerce Commission were not ready until 1937 when, with the approval of the Locomotive Design Committee of Division V, of the Association of American Railroads, and the Bureau of Safety of the Interstate Commerce Commission, the American Locomotive Company built an experimental all-welded boiler. This was applied to a chassis of the Delaware and Hudson Co., conformable with the railroad's class H-6, a 2-8-0- type locomotive, among the heaviest of this type in service.

The Interstate Commerce Commission required that this boiler should operate as a stationary boiler for a preliminary service period, and to this requirement the railway added the provision of keeping the engine in yard service for several months before it was put on the road. The monthly, quarterly and annual boiler inspections have resulted in uniform reports of: "No leaks—not even a simmer," "all right," etc.

The entire boiler is built by butt welding together sheets which are in general of the normal form and thickness of the conventional boiler, retaining the usual stay bolt construction of the latter. The shell is made of a single sheet. For the usual throat sheet, a sheet making a ring continuous around the top of the back end of the shell is used. For the dome, the normal pressed form is used, except that the skirt flange is made quite narrow, and is fitted and welded into a hole in the top of the shell, with a liner under the welded seam. The welds in the shell and outside firebox were stress-relieved in accordance with the requirements of the ASME power boiler code.

The success of the project in general, including the saving of over a ton of weight, has resulted already in arrangements to build additional boilers of this type.

» «

Locomotive Parts Fabrication

By J. W. Kenefic

Supt. Railroad Service, Western Div., Air Reduction Sales Co.

ABOUT 90% of locomotive parts can be economically fabricated in railroad shops. Since the introduction of a special bearing bronze welding metal for bearing surfaces six years ago, many successful applications have been developed. Chief among these is the building up of driving box laterals. The bronze can be applied by the metal or carbon-arc methods, and little experience is necessary. Weld-deposited laterals have the advantage of not coming loose and need no replacement; only an additional overlay is necessary occasionally to replace the metal worn away.

Crown brasses are also reclaimed with bearing bronze, by building up with weld metal and machining and deposit. Likewise driving box shoes and wedges are restored, though some roads build up on the corresponding face of the driving box instead.

Among other locomotive parts which may be built up on bearing surfaces with this bronze are trailer truck lateral plates, fabricated crosshead shoes, etc.

Under the subject of fabrication of locomotive parts, this paper also included a complete description of the welded fabrication of locomotive driving boxes. These are made up of three flame-cut steel parts, welded together. The crown brass is deposited entirely by welding, and the box is babbitt finished. The fabricated box requires only 38 lbs of brass in the crown, compared to 200 lbs for the customary cast crown brass.

» «

Weld-Bead Hardness Tests

By OSCAR E. HARDER *and* C. B. VOLDRICH
Battelle Memorial Institute

WELD-BEAD hardness tests, using the tentative tests adopted by AWS, were made on 34 War Department steels. These steels included 22 plain carbon steels, 3 nickel steels and 9 chromium-nickel steels. All of the steels were tested at original plate temperatures of 65 F; those steels which developed hardnesses in excess of 350 Vickers or showed cracks were welded at plate temperatures of 300 F, while steels which developed maximum hardness below 350 were welded at -20 F.

The paper gave details for the composition of the steels, forging and normalizing practice, and welding and testing procedures. The lowest hardness at which a crack was found was 566 Vickers. Of the six steels which cracked with plate temperatures of 65 F, only one cracked when the plate temperature was raised to 300 F. Increasing the plate temperature from 65 to 300 F decreased the hardness from 566 to 421 for one steel. Decreasing the plate temperature from 65 F to -20 F had only a slight effect in increasing the maximum hardness, and in some cases lower hardness values were obtained.

» «

Why the Weld Recorder?

By J. VAN DEN BEEMT *and* J. R. FETCHER
E. G. Budd Mfg. Co.

THIS PAPER described the theoretical and practical application of the Ampere-Squared-Second-Recorder in checking the "invisible" resistance welding variables, Current and Time. (The other three variables which determine the resistance, R, can be controlled by visual shop supervision.) The recorder can be used only with synchronously controlled welding timers and is considered as an accessory to good line regulation, voltage compensation, sequence timing and other devices for providing uniform welding control.

The purpose of the recorder is to compare the electrical conditions under which a test weld is made to those of the welds made on the job. When used intelligently, it is said to be of great assistance to the production, welding supervision and welding maintenance departments.

» «

Spot Welding Heavy Gauge Steel

By JOHN C. BARRETT
Taylor-Winfield Corp.

THIS PAPER described a heavy press welder, designed by the author's company and equipped to provide seven different currents during seven different time intervals as well as three additional time intervals for "off" times. These features make it possible to weld and heat treat hardenable steels in the welder by applying the proper values of current for the appropriate times. The welder was also equipped with a dual pressure system, which helps to prevent porosity and cracking in the weld.

The steels studied were SAE 1020, SAE 1065 and SAE 4130, in sizes from ¼ to ¾ in. thick. Heat treatment, largely confined to the latter two steels, consisted of a grain-refining treatment and a tempering treatment.

The investigations included studies of the proper welding procedure and of the type, times and temperatures of heat treatment to obtain high weld strengths. Excellence of welds was evaluated by shear and drop impact tests, by metallographic analyses, and by hardness surveys. Of these tests, the drop impact test proved to be the most valuable for determining proper techniques.

» «

Stored Energy Welding of Mild Steel

By J. M. DIEBOLD
Yellow Truck & Coach Mfg. Co.

A STORED energy welder was purchased by the company for the express purpose of studying its welding characteristics on copper, stainless steel and mild steel as well as on aluminum. The studies on mild steel were especially interesting because of the uniformity and minimum indentation found when using the stored energy machine. Runs varying both heat and pressure were made from the start of coupon adherence to the point at which the electrodes fused to the metal in order to get as complete data as possible.

According to the results of this study, the welding range of mild steel falls into four definite zones which are controlled by weld bead growth. Welding in the third zone proved to be the most reliable and best for production work from the standpoints of metal finishing, tip life and the omission of flashing, spitting and extruding while welding.

Quality of the welds made on a stored energy machine was found very uniform. The upper limit of the machine used was 10 gauge mild steel.

Enough information was obtained from the data to demonstrate the necessity for a weldability specification on mild steel if close control of weld strength uniformity is necessary. The variation found in steel weld strength was much greater than the variation of the machine. Steel weld strength variation will have to be studied in the future if real weld consistency is to be obtained, the author concluded.

» «

Flash Welding of Nickel

By W. F. HESS *and* ALBERT MULLER
Rensselaer Polytechnic Institute

THIS PAPER discussed the establishment of satisfactory conditions for flash welding ¼ and ⅜ in. diam. rods of nickel, Monel, "K" Monel and Inconel. In order to establish these conditions, it was first necessary to study the changes in weld quality produced by changes in welding variables. The more important welding variables are: cam shape, flashing distance, flashing time, amount of upset, time of current flow during upset, available short-circuit power level and material preparation prior to welding.

Three major defects may be found in flash welds in the materials studied as the result of improper machine settings. These defects consist of fine oxide at the weld interface, trapped dendritic material at the weld interface, and partial melting of the grain boundaries in the weld region.

» «

Planning for Shipyard Welding and Cutting

By W. B. BOWEN
Welding Superintendent,
Ingalls Shipbuilding Corporation

THIS PAPER covered the production methods instituted by the Ingalls Shipbuilding Corp. at Pascagoula and by the Ingalls Iron Works at Birmingham, the coördination between these two points, the adaptation of the Birmingham structural fabrication facilities to shipbuilding activities and the organization of the assembly shipyard at Pascagoula. It was the unique problems arising from the 350-mile separation between fabricating shops and erection shipways that formed the chief points of discussion.

The C-3 vessel constructed at the Ingalls yard is all welded, using not a single rivet. Much more complex in design than the Liberty ship, it can be readily converted to cargo-passenger, transport or Naval use.

The Ingalls shipbuilding plan utilizes the extensive structural fabrication facilities at the Birmingham plants for the purpose of sizing, shaping and assembling as many of the primary assemblies and subassemblies as can be shipped by rail or truck to the Pascagoula yard 350 miles away. Production at Birmingham is based on the fabrication of units for five ships at a time. Almost all of the structural fabrication facilities, such as bending presses, drills, shears, punches, etc., formerly required for regular structural fabrication, are now being used to turn out ship parts.

The shipyard itself was designed at the start for all-welded shipbuilding and was the first yard ever to be planned on this basis. In discussing the welding procedures followed, the author described in some detail the specific techniques applied on certain types of seams and assemblies, electrode sizes used and weld footages per hour.

» «

Evaluating Weldability of Alloy Steels

By S. A. HERRES
1st Lt., Ordnance Dept.

WELDING a given steel into a structure which will not fail was stated by Lieutenant Herres to be dependent upon avoidance of the following difficulties: (1) formation of base metal cracks; (2) development of unsuitable mechanical properties in the weld heat-affected zone of the base metal; (3) contamination of the weld metal by elements from the base metal; and (4) development of high stresses during welding. All of these were covered in detail.

(Digests of Convention Papers continued on page 74)

Welding Big Crane Girders

Two traveling automatic welding heads are used to weld both webs of a girder simultaneously to one cover plate. The two fillet welds are deposited at rates of from 35 to 50 ft of bead per hour.

By **R. L. KOHLBRY**
Vice-President, Machinery and Welder Corporation

FOR NEARLY 60 years, the Whiting Corporation, of Harvey, Ill., has specialized in the manufacture of overhead traveling cranes. Today, the company is facilitating the handling of bulky war material by producing large quantities of simplified "Victory Cranes," which are as stripped of all non-essentials as a battleship preparing for action.

Welding and Flame-Cutting

In the manufacture of these wartime cranes, readily available materials are employed to the maximum extent, and many time-saving processes such as welding and flame-cutting have been adapted to speed production of the massive crane girders. Flame-cutting is used to shape the webs, cover plates and stiffeners from heavy plate stock, while a special automatic welding technique facilitates fabrication of the big girders.

Girders used in the support of such overhead traveling cranes as shown in Fig. 1 measure from 35 ft to 125 ft in length, 7½ to 10 ft in height, 12 in. to 30 in. in width. Their top and bottom cover plates are made of ⅜ in. to 1¼ in. plate. The webs are of ¼ in. to ⅜ in. plate stock. Stiffener plates of the same thickness as the side plates of a girder are inserted perpendicular to the webs at intervals depending upon the size of the particular girder.

Planning for Automatic Welding

To increase output with decreased welding man-hours, the company decided to convert to automatic arc welding for the long horizontal fillets which join the webs to the top and bottom cover plates. (Automatic welding is not used for the stiffener plates.) A preliminary analysis of the job showed that the most efficient procedure would be to weld the two bottom seams at the same time, in a horizontal position, and then turn the girder bottomside up for the welding of the two seams joining the other cover plate to the webs. Thus each girder would require four ¼ to ⅜ in. horizontal fillet welds running the full length of the girder —from 35 to 125 ft. Twin traveling automatic welding heads to operate simultaneously on both sides of the girder were decided upon as the best method of meeting the above requirements.

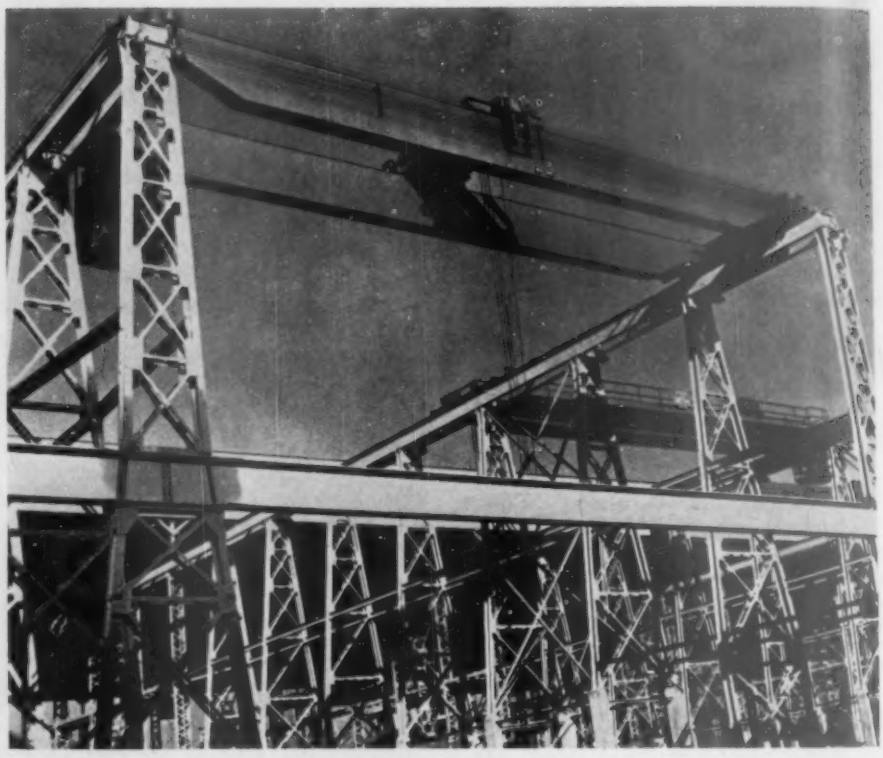


Fig. 1—This 10-ton traveling crane built by the Whiting Corp. has a span of 74 ft 8½ in. and presents a neat streamlined appearance due to flame-cutting and automatic arc welding.

Motor-Driven Floor Cranes

In designing the automatic welding equipment, the Whiting Corp. drew heavily upon its long experience in the manufacture of traveling cranes. The traveling mechanisms, Fig. 2, are really floor cranes; they are driven along rails by a motor and have the necessary controls to permit selection of the proper traveling speed for the particular job in progress. Flexibility in the spacing of the heads to accommodate beams of different widths is obtained by a sliding arm mounting. These units can be used at any height (within the limitations of the equipment) and to weld at any angle. They can also be reversed at the end of a continuous seam and turned back to weld in the opposite direction—a decided advantage and a great time-saver.

A-C Welding Heads

Each traveling unit carries a 500 amp A-C welder and an automatic welding head. The welder is a standard transformer-type with capacitors, assuring high efficiency, good power factor and the elimination of arc blow. Heavily coated electrodes for shielded-arc welding are coiled in reels above the welding heads and fed automatically to the work as the

Fig. 2—Crane beams to be welded are placed between the two welding units, which are driven along rails by a motor and speed reducer drive. These units carry all the necessary controls, a 500 amp A-C welder and an automatic welding head. Flexibility in the spacing of the heads to accommodate beams of different widths is obtained by a sliding arm mounting.

welding progresses. An E-6020 class (horizontal fillet) electrode is used in diameters of 3/16 and 1/4 in. Welding speeds of 10 in. per min for the 1/4 in. fillets and 7 in. per min for the 3/8 in. fillets can be attained. These speeds, of 50 ft and 35 ft per hr respectively, compare with the 35 ft per hr of 1/4 in. bead and 20 ft per hr of 3/8 in. bead that can be deposited by a fast hand weldor.

Uniform Welds

The use of automatic equipment in a measure simplifies the welding operation and insures uniformity. Aided by the sliding arms of the traveling floor crane, the automatic head can be placed in position for welding; then angular adjustments may be obtained by means of a swivel joint By varying the angular adjustment, it is possible to vary the shape of the fillet so that an equal leg or unequal leg fillet may be obtained as desired. Arc length adjustment is obtained by means of a hand screw in the head itself.

These controls, coupled with the speed control which regulates the rate of travel of the entire self-contained welding unit, make possible the production of near-perfect welds—or at least welds of more uniform quality than can be consistently produced by manual methods. The simultaneous welding tends to equalize the heat distribution and consequently minimize any tendencies toward distortion.

Advantages

The advantages for this automatic welding set-up are numerous. No joint preparation is required, the horizontal and vertical plates being simply placed together at right angles. Both horizontal welds are made at the same time, decreasing the overall delivery time of these girders. Moreover, the actual speed increase has been quite material—enough so as to warrant the expense of the automatic equipment. Interruptions to welding caused by electrode-changing in the hand process are eliminated by the coil electrodes. The finished product has also been improved in appearance because of the completely uniform welds.

Other advantages are of equal importance. By eliminating the factor of operator fatigue, production is kept up at a constant level through the whole shift. The problem of positioning does not exist any longer. Arc length and speed can be closely controlled, thus assuring control over the distortion produced by the welding heat. Most important of all, however, is that the production of crane girders has been materially increased by the use of this process.

Because of heavy wartime demands, this automatic equipment has to date been used solely for the welding of crane girders. However, the company expects to use it for other purposes and on other products when the present emergency is over.

Fig. 3—A close-up of the automatic head. An E-6020 electrode in continuous coil form is used to deposit a 1/4 or 3/8 in. horizontal fillet weld.

Welding Methods for Copper and Copper Alloys*

★Part One—The welding of copper and its alloys, the brasses and bronzes, has shown considerable advancement because of the increasing use of the carbon arc, coupled with the use of the silicon-bronze filler rod.

By **J. J. VREELAND**
Metallurgical Engineer,
Chase Brass & Copper Co.

THIS PAPER is to deal predominantly with the welding (fusion) of copper and its alloys, which should not be confused with the brazing of these alloys. It must also be pointed out that "bronze welding," as the term is generally used in industry, is a brazing process using brass brazing rods such as naval brass, low fuming bronze and manganese bronze. The term "bronze welding" as used in this paper will refer to the welding of bronzes with bronze welding rods.

Gas or Carbon Arc

The choice of welding method and welding rod to be used naturally depends on the alloy and gauge of material being welded. Thin-gauge metal usually cannot be properly welded with the carbon-arc method because of the likelihood of burning through. Oxy-acetylene welding should be chosen for most thin gauge material because of its lower heat and better control of weld metal.

The shape of the unit being fabricated is another factor in the selection of the proper welding method. More warpage can be expected on shapes other than tubular, and so the carbon arc would take preference here since it produces less warpage. Again, it is impossible on some materials to weld overhead with the carbon arc, necessitating the use of the oxy-acetylene method.

The choice of welding rod is governed by the choice of welding method and by the type of service the finished unit is subjected to. Consideration should be given to the amount of cold working the welded joint may be subjected to after completion. Corrosion resistance of the weld should be considered when the finished unit is expected to operate under corrosive conditions.

Necessary Operations

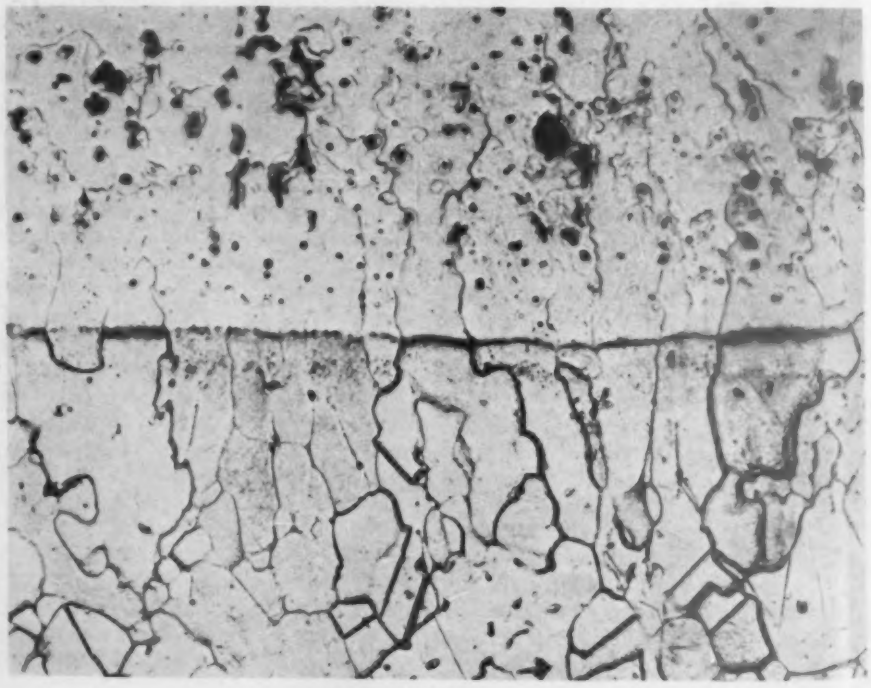
In all welding, best results are only possible when certain precautions are taken. Removal of dirt, grease and oxides must be effected. The proper flux should be used, and the resulting slag formed from each welding bead must be removed in order to obtain the maximum density in joints requiring multiple bead welding.

Proper jigging and proper welding technique are also factors governing results. Excessive movement of metal during a welding operation may result in considerable trouble. In carbon-arc welding, tack welding should be done every 6 to 8 in. in order to minimize the movement of the base metal. In oxy-acetylene welding, a proper allowance in the set-up of the welding joint must be made for the expansion or movement of metal during the preheating and welding periods. Quite often auxiliary torches should be used to bring the metal up to welding heat and to continue to supply heat to the base metal in order to facilitate welding.

In carbon-arc welding, it is permissible for the operator to stop welding at any time. When welding is resumed, however, it is quite important that the arc be struck at a point approximately 1 in. back from the start.

**Abstracted from a paper presented at the annual meeting, AWS, Chicago, Oct. 18 to 21.*

Fig. 1—A carbon-arc weld of tough pitch copper made with a high-tin phosphor-bronze welding rod. Note the intergranular bond and porosity in weld metal. The dark spots are copper-cuprous oxide eutectic in the base metal. Joint strength: 27,500 psi; magnification: 75X.



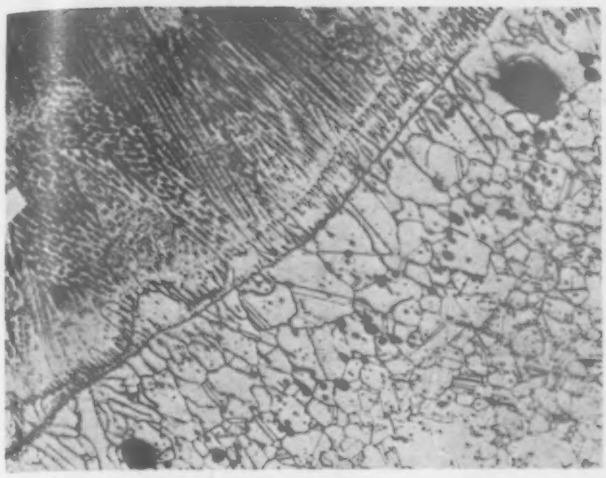


Fig. 2—A carbon-arc weld of tough pitch copper made with a silicon-bronze welding rod. Note the large holes in the base metal due to reduction of copper-cuprous oxide eutectic. Joint strength: 18,000 psi; magnification: 75X.

No filler rod is added until the arc has been brought up to the point where the stop occurred. If the metal requires a slight preheat for successful carbon-arc welding, it is advisable to preheat slightly before resuming the weld after a stop which has been long enough to allow the metal to cool to room temperature.

In oxy-acetylene welding, it is not advisable to stop the welding for any period which permits much loss of heat in the base metal. If such stops in welding are absolutely necessary, preheating torches should be used to maintain the necessary heat in the base metal until welding can be resumed.

Welding Tough Pitch Copper

Oxy-acetylene welding of copper has been done for many years using welding rods of tough pitch copper, deoxidized copper and silver-bearing copper. Fairly satisfactory results were obtained, but hot working and cold working of the weld were requisites for good physical properties and density. The type of copper used (tough pitch) does not lend itself very well to gas welding methods.

Tough pitch copper containing a small percentage of oxygen in the form of copper-cuprous oxide eutectic should not be welded with the oxy-acetylene method. When tough pitch copper is heated up to approximately 1,680 F and higher, accumulations of the copper-cuprous oxide eutectic will occur in the grain boundaries. The extent of this segregation will depend upon both the time the copper is held at this elevated temperature and upon the temperature itself. Considerable segregation will occur when the copper is actually melted. The segregation of the copper-cuprous oxide at least partially explains the inferior results obtained in attempting to weld the heavier gauges of tough pitch copper by means of the oxy-acetylene method. Thinner gauge copper can be welded more successfully because of the minimum length of time the copper is above the temperature at which segregation occurs. Brazing operations are performed at temperatures below or very slightly above this critical temperature, and no apparent segregation occurs.

Carbon-Arc Welding

Carbon-arc welding of gauges of tough pitch copper heavier than $\frac{1}{16}$ in. has shown no tendency toward copper-cuprous oxide segregations. Phosphor-bronze type welding rods are recommended. The low-tin (1½%) or the high-tin (8-10%) rods have the necessary high fluidity and ability to withstand the high heat of welding. Both welding rod compositions contain residual phosphorous (approximately 0.3%), which is added as a self-fluxing agent. Satisfactory results are obtained. However, it is not advisable to weld thicknesses of copper heavier than $\frac{3}{8}$ in. with the phosphor-bronze type of welding rod, since multiple bead welding has not proved successful because of the hot shortness of the deposited weld metal.

The low-tin phosphor bronze is capable of withstanding cold working after deposition and should be used for fabrication if any cold working is to be done after welding. The high-tin phosphor-bronze weld metal is hard and brittle and will withstand only moderate cold working. Both rods handle equally well under the arc, with the high-tin rod taking preference for the welding of heavier gauges. Fig. 1 illustrates the structure obtained with a carbon arc weld of tough pitch copper using a high-tin phosphor-bronze rod.

Silicon-bronze rod should not be used for the welding of tough pitch copper. Lineal welding speeds are reduced about 40% as compared to speeds using phosphor-bronze welding rods because of the lower fluidity of silicon bronze. The slower welding speeds are responsible for a wider zone of reduction of the copper-cuprous oxide eutectic, yielding low tensile and free bend values. Fig. 2 illustrates the greater amount of reduction adjacent to the weld metal.

Deoxidized Copper

The use of deoxidized copper for welding work eliminates faulty re-

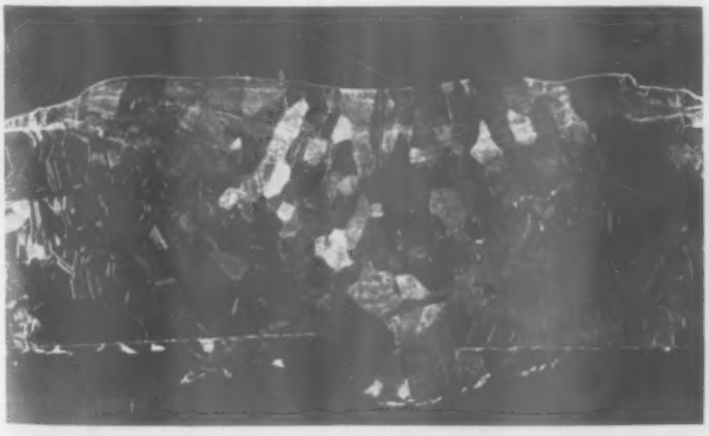


Fig. 3—An oxy-acetylene weld on $\frac{3}{8}$ in. deoxidized copper that was made with a silicon-copper welding rod. Joint strength: 30,000 psi; magnification 2X.

Fig. 4—A carbon-arc weld of deoxidized copper made with a high-silicon bronze rod. Joint strength: 32,300 psi; magnification, 2X.

sults attributable to the base metal. No copper-cuprous oxide eutectic occurs in deoxidized copper so there can be neither segregation nor reduction of the copper-cuprous oxide eutectic adjacent to the weld. The success of this welding will depend upon the choice of welding rod, capacity of heat available and welding technique employed.

tends to permit faster lineal welding speed. For thicknesses over 3/16 in., this high fluidity increases the likelihood of a brazed joint instead of a weld. The resulting tensile strengths (non-reinforced) are much less than 25,000 psi.

The use of a silicon-copper welding rod containing approximately 0.15% to 0.3% silicon will produce

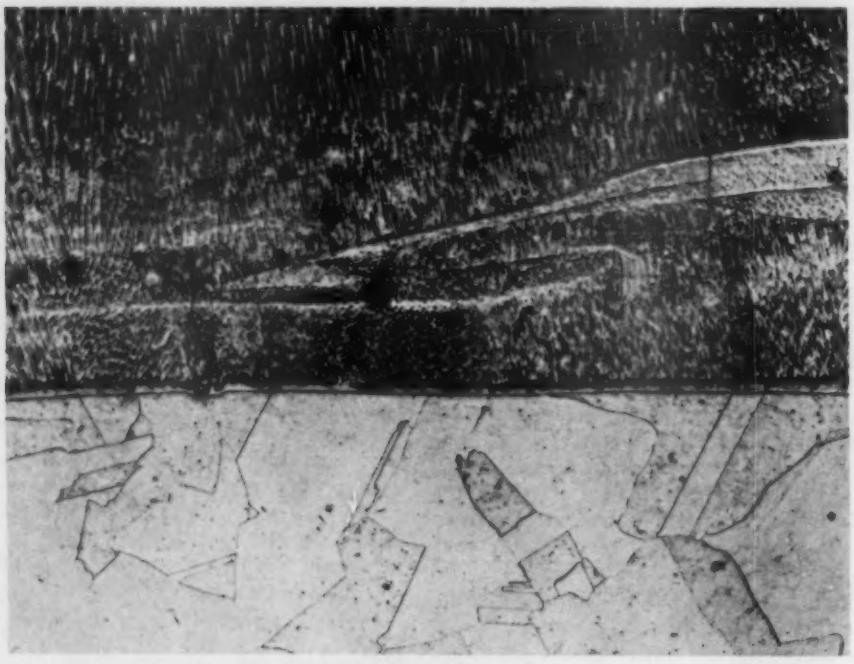


Fig. 5—Junction of weld metal and base metal of the weld shown in Fig. 4. Note structure of the weld metal and the intergranular bond at the junction; magnification, 75X.

Rods for Gas Welding

Oxy-acetylene welding of deoxidized copper has been used for a number of years, and the results obtained have been directly dependent on the welding rod used. A tough pitch copper welding rod tends toward a highly porous weld, with tensile strengths (non-reinforced) running approximately 18,000 psi. This rod handles satisfactorily with a flux designed for copper welding.

Phosphorous deoxidized copper and silver-bearing deoxidized copper welding rods give dense deposited weld metal with tensile values of approximately 25,000 psi. The main objection to phosphorous deoxidized copper rods is the high fluidity of the weld metal, which makes them hard to handle for welding in all positions. Satisfactory results are obtained on thicknesses of copper under 3/16 in. when welding is done in the horizontal position, but extreme difficulty is encountered on vertical-horizontal and overhead welds. When attempting these types of welds, the highly fluid weld metal tends to run out of the joint.

The high fluidity of these rods exceptional results as to tensile strength, ease of welding in all positions and soundness of weld deposits. The small amount of silicon present lowers the apparent fluidity so that a smaller pool of weld metal is obtained during the welding process. Positive fusion is more certain because of the lesser tendency of the weld to run ahead of the welding flame. Furthermore, the same sluggishness of weld metal makes vertical-horizontal and overhead welding easier, assuring the operator of obtaining satisfactory fusion and physical properties. Fig. 3 illustrates the typical structure obtained for an oxy-acetylene weld of deoxidized copper using a silicon-copper welding rod. To insure maximum density and freedom from slag pockets, a satisfactory copper welding flux should be used.

When using the silicon-copper welding rod, no back-up bar or chill strip is required. With the proper precaution and correct welding rod size, satisfactory penetration can be obtained. Because of its good results and comparative ease of welding in all positions, this method of welding is recommended over other methods for pipes and tubing.

Oxy-acetylene brazing of either type of copper can be very easily done using the conventional yellow brass brazing rods such as naval brass, manganese bronze, low fuming bronze and Muntz metal. The results obtained will depend on the type of flux used and the skill of the operator.

Carbon-Arc Welding

Successful carbon-arc welding of deoxidized copper depends both upon the choice of welding rod and the capacity of heat available. It must be remembered that, because of the high thermal conductivity of copper, high amperages and voltages are required to compensate for the rate of heat dissipation. A 600 amp machine should be used, one that is capable of holding an arc drawing at least 50 v while welding. It is acceptable prac-

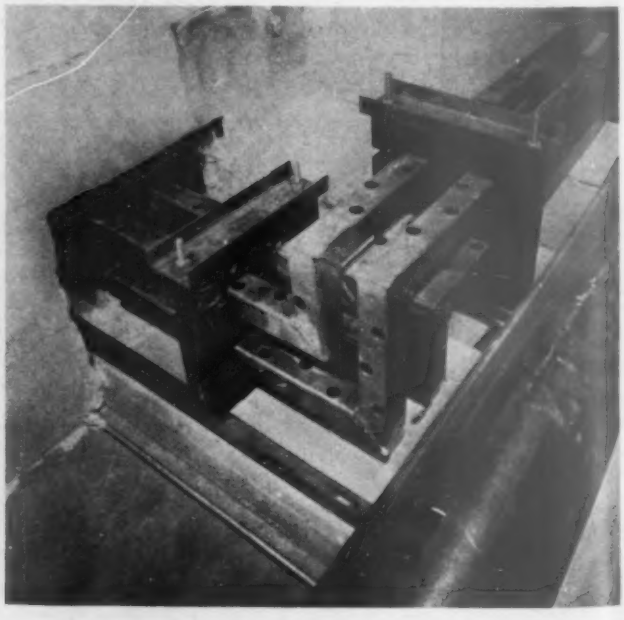


Fig. 6—A square tubular bus installation preassembled by carbon-arc welding. Low-tin phosphor-bronze welding rods were used for this job.

Fig. 7—A deoxidized copper pressure vessel that was carbon-arc welded with high-silicon bronze welding rods.

tice on gauges of ¼ in. and heavier to preheat the copper slightly in order to insure more sound weld metal and to lower the starting heat requirements.

Extensive investigations have proved that the silicon-bronze type of rod containing approximately 3% silicon is a superior rod for the carbon-arc welding method. The weld metal is not extremely fluid under the arc, as is the case with phosphor-bronze rods, so welding speeds must be slower to insure a satisfactory density of weld metal. To obtain the maximum density of weld metal, a flux designed to slag off silicon oxide must be used.

Phosphor-bronze Grade D welding rod has been used quite successfully for the carbon-arc welding of deoxidized copper. Since multiple bead welding is not recommended with this type of rod, the thickness of copper is limited to ⅜ in. (similar to the recommendation given for the carbon-arc welding of tough pitch copper). The ductility of the weld metal is not sufficient to allow much cold working or forming after welding.

The high fluidity of the weld metal on heavier gauges of copper has a tendency to cause cold laps. To minimize this, the work should be tilted at an angle of 7 to 15 deg so that the welding will be done slightly uphill to prevent the weld metal from flowing ahead of the arc.

All carbon-arc welding of copper should be done in a downhand position, and the joint should be backed up with a copper chill bar or strip. If the bar is to be used and removed after welding, its thickness should not be less than ⅜ in. It is recommended that a groove approximately ¼ in. wide and 1/32 in. deep be machined in the bar to aid in obtaining a proper penetration. Often, a chill strip approximately ⅛ in. thick could be used and left as a reinforcement on the underside of the weld.

Fig. 4 is a carbon-arc weld of deoxidized copper that was made with a silicon-bronze rod. Fig. 5 shows a much greater magnification of the junction of the weld metal and the base metal. In this illustration the structure of the weld metal and the intergranular bond of the junction can be viewed with great clarity.

The carbon-arc method is not recommended as practicable for the welding of copper pipe unless a chill strip is used and all welds are rolling welds. Due to the necessity of maintaining high heats, burning through would result if no chill strip were used. It is very difficult to weld by this method in a vertical or overhead position.

Fig. 6 is an installation of square tubular bus, preassembled by carbon-arc welding using low-tin phosphor-bronze rods. Fig. 7 illustrates the application of carbon-arc welding of deoxidized copper to pressure vessels, using high-silicon-bronze rods. Fig. 8 shows parts of an alcohol and ether processing plant. The deoxidized copper was welded with high-silicon-bronze rods and underwent considerable cold-forming operations. However, the welded joints took the cold-forming operations without signs of fracturing.

Copper Alloys

The welding of copper-zinc alloys (brasses) and copper-tin alloys (bronzes) will be discussed in detail in a later installment of this paper. It should be noted here, however, that the methods to be described will be largely "bronze welding" used in the sense mentioned in the first paragraph and not brazing. Brazing, it might be interesting to note, is defined in the *Welding Handbook* as: "a group of metal-joining processes wherein the filler metal is a non-ferrous metal or alloy whose melting point is higher than 1,000 F but is lower than that of the metals or alloys being joined." To carry the distinction further, the *Handbook* also states that: "The melting points of the filler rod and the base metal determine whether the process used is welding or brazing—whether the side walls of the base metal are melted or not."

In discussing the welding of the brasses, it will be necessary to consider separately the welding of the high-copper or "red" brasses (copper content around 80% or more) and the high-zinc or "yellow" brasses, such as Muntz metal and naval brass, with copper contents ranging from 58% to 80%.

Under the bronzes, it will be necessary to consider silicon bronzes (copper-silicon alloys), phosphor bronzes, aluminum bronze and beryllium bronze.

Part Two, dealing with the welding of high-copper brasses, high-zinc brasses and the various bronzes, will be published in an early issue of THE WELDING ENGINEER.

Fig. 8—A deoxidized copper alcohol and ether processing plant. The welding was done with the carbon arc using high-silicon bronze welding rods.

Applying Flash Welding To Airplane Construction*

Speed and strength are the two big advantages of flash welding—a process that is steadily growing in popularity throughout the aircraft industry. Tests show that non-heat-treated welds in chrome-moly tubing are equal in strength to unwelded materials of the same analysis.

By **C. B. SMITH**
Process Engineering Dept.,
Douglas Aircraft Co., Inc.

About five years ago, the Douglas Company purchased its first flash-weld machine. This investment was not made without misgivings on the part of some who questioned the wisdom of the outlay of such a large amount of cash. The machine was not purchased blindly, however, because the backers of the flash-weld process at Douglas had several applications in mind for it. The job which had been particularly troublesome was the fabrication of a heavy boiler flange. The total welding area was in excess of 2 sq in.; consequently, a 450 kva machine was purchased.

Within a few months after the first machine had been delivered and put to work, it had saved its price in material and machine shop time. From then on, the use of flash welding in the aircraft industry was assured.

The Flash-Welding Process

In order to eliminate confusion, it seems advisable at this point to describe the process as we are using it for the welding of aircraft parts. "Flash welding" is the formation of a butt-type weld by means of an automatic flash-welding machine. The machine is a precision device of rugged construction. In its bare essentials it consists of one stationary platen and one movable platen mounted on accurate ways. The platens, in the electrical sense, are insulated from each other. Some sort of automatic drive unit is incorporated to control the motion of the movable platen toward the stationary one. A set of current-carrying "dies" is mounted on each platen and connected to a transformer so that the die sets will be opposite in polarity. Each of the two parts to be welded is clamped in its die in such a manner that it protrudes toward the other part in accurate alignment. Suitable back stops or locating fixtures, if required, may also be mounted on the platens.

Flashing Contact Areas

An alternating current of high intensity but low voltage is now applied, and one part is moved toward the other. When the parts come into contact, the contact areas are flashed away by the intense current. The motion of one part toward the other is so regulated that steady vigorous flashing is maintained, thus providing both a heating and a cleansing action. Flashing is caused to cease by suddenly forging the heated parts together and turning off the current before excessive heating during this "upset" period can occur and destroy or "burn out" the weld.

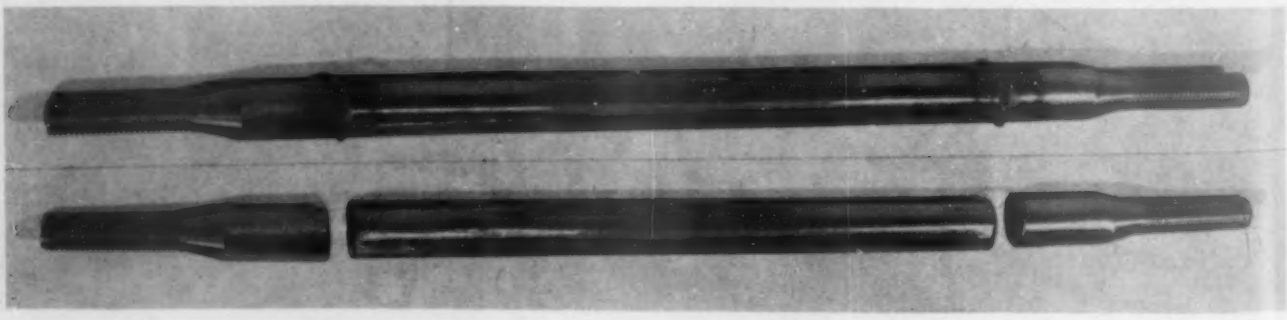
Automatic Action

The machine is automatic in that, once set up, it repeats each cycle in nearly an identical manner. Control adjustments are provided for the current magnitude, the travel time, the distance traveled during the flashing period, the platen speed at any point in the cycle and the time at which the current is turned off with relation to the upset action. The methods used by different equipment manufacturers for making these adjustments vary somewhat, as do other details of machine construction; consequently, flash-welding applications have been strongly influenced by equipment design.

Since the first machine was purchased to do a specific job, only enough preliminary research was done to develop machine settings which would consistently produce satisfactory welds for this application. As each new application ap-

* *Abstracted from a paper presented at the annual meeting, AWS, Chicago, Oct. 18 to 21.*

Fig. 2—The two threaded sections are welded to either end of ⅛ in. chrome-moly tubing in order to form this engine control rod.



WELD OPERATION SHEET

DRAWING NUMBER _____
LATEST DWG. CHANGE _____
PLANNING NUMBER _____
APPROVAL _____
DATE APPROVED _____

MATERIAL DESCRIPTION: _____

AREA OF CROSS SECTION AT WELD (SQ. IN.) _____

MACHINE TO BE USED _____

TOOLING TO BE USED _____

TOTAL LOSS PER WELD _____ TEMPLATE OR CAM NUMBER _____

CURRENT SETTING _____ SPEED SETTING _____

ADDITIONAL MACHINE SETTINGS - TO BE MADE IN THE ORDER GIVEN

1. _____ 6. _____
2. _____ 7. _____
3. _____ 8. _____
4. _____ 9. _____
5. _____ 10. _____

PRODUCTION RECORD

FILL IN THE DATA REQUIRED BELOW. MAKE A TEST AS FOLLOWS: _____

MINIMUM ACCEPTABLE REQUIREMENTS ARE: _____

RECORD "W" AFTER FAILING LOAD FOR FAILURE IN WELD - "P" FOR FAILURE IN PARENT MATERIAL.

ORDER NO.	SERIAL NO.	NO. OF PARTS	DATE	OPERATOR	SET UP CHECK	PRODUCTION TEST		

Fig. 1—"Set-up" card for each job. This gives the correct settings for all the machine variables and eliminates the use of the more complicatd machine calibration charts developed as a result of testing sample welds.

peared, similar cut-and-try tests were run. As a result of these tests, it became apparent that one size of machine was inadequate to cover the entire range of aircraft applications, and that definite engineering design data must be developed. Accordingly, an additional machine of 50 kva rating was purchased and a research program established.

Two problems were in immediate need of solution:

1. The development of a flash-welding technique which would consistently produce reliable results.
2. The determination of the strength values of flash welds made using this technique.

Finding Proper Settings

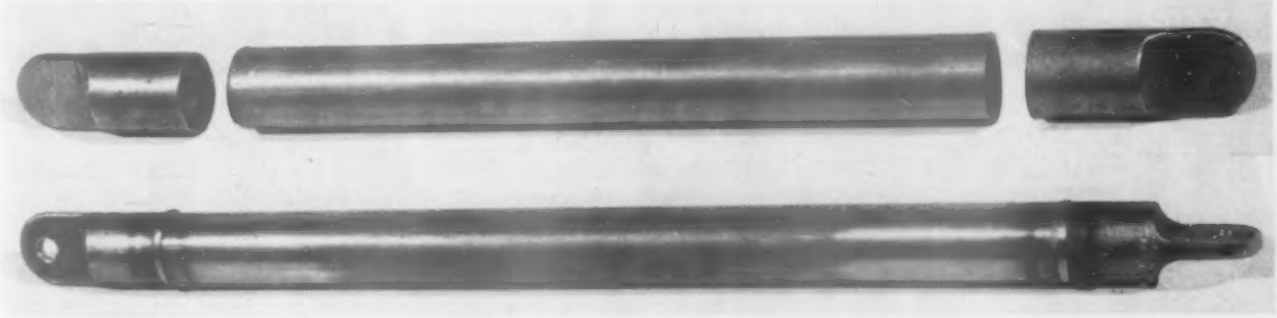
The investigators discovered that a comparatively large number of setting combinations would produce what appeared to be sound welds. With so many welding variables, some arbitrary selection of constants seemed necessary if any progress was to be made. This selection of constants was based on recommendations received from one of the welding machine manufacturers for the flash welding of mild steel of rectangular cross-section. Inasmuch as aircraft applications are largely alloy steel tubing, before use could be made of the recommendations it was necessary to convert our tube section to its equivalent rectangular section. This was done by simply considering that the same thickness applied for each, and dividing the area of cross-section of the tube by its thickness in order to obtain the equivalent width dimension. According to the recommendation, width and thickness governed the total loss, of which about one-fifth was upset travel. The final or closed position of the clamping dies was based on thickness; the time used for flashing was based on area of cross-section; the current was to be set as needed. Many welds were made using settings based on these recommendations, and the results were very gratifying.

It was soon found that both the welders in use were too large in capacity for many small assemblies where flash welding seemed to be the most logical welding process. As a result, a 10 kva machine was purchased. These three machines, the 450, the 50 and the 10, seemed to provide adequate coverage of the welding range, although there was very little overlapping. Extra equipment such as auxiliary autotransformers and a wide selection of cam shapes has increased the overlapping of machine ranges and has led to more consistent welding and more satisfactory performance.

Tests Prove Weld Strength

Samples of alloy steels were welded at proved settings and submitted for fatigue and tensile tests. In nearly every case tested, the parts failed at considerable distance from the weld, and those few which failed in the weld broke at values comparable to an unwelded control specimen. These tests have resulted in the acceptance of non-heat-treated flash welds as having a strength equal to that of unwelded material of the same analysis in the normalized condition. Thus assemblies consisting of heat-treated end fittings flash welded to a normalized tube will, in general, require no subsequent heat treatment, provided the normalized tube is sufficiently strong. If a uniform strength at a higher value than normalized is required, then heat treatment is recommended after welding unless exhaustive tests prove otherwise. This acceptance of flash welds at 100% of the full strength of the parent material gives this process a weight-

Fig. 3—Oil cooler support. Special locating fixtures are required in order to hold the proper rotational relationship of the two end fittings.



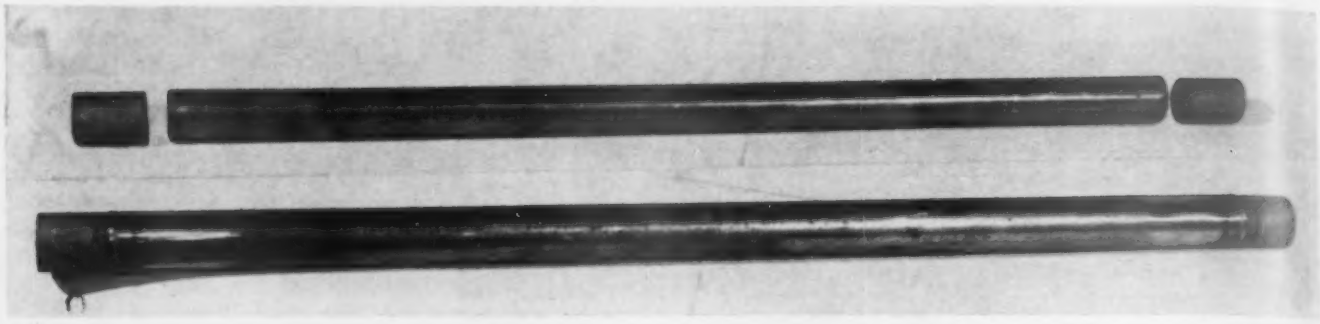


Fig. 4—Flash-welded engine mount strut. This assembly consists of heat-treated ends welded to normalized 1⅛ in. tubing. Both ends and tubing are of X-4130 chrome-moly steel.

saving advantage over gas or arc welds, which are frequently considered by aircraft design engineers to develop a joint efficiency of 80%.

The preliminary test results had been so favorable that the design engineers had released a number of new assemblies. Consequently, production had reached a level so that severe problems in respect to process control arose. Operator training was perhaps one of the most serious of these. In order to produce parts which would meet the tolerance requirements, the operator had to be able to read the blueprint, read machine calibration charts developed as a result of the tests and have the mechanical ability to make precise adjustments on the machine.

"Set-up" Cards for Each Job

The major part of the solution to the operator training problem came as the result of eliminating the use of calibration charts. This was accomplished through the establishment of "set-up" cards (Fig. 1) for each job, on which appear the correct settings for all the machine variables.

A control procedure somewhat similar to that customarily used for spot welding was established. Test coupons are to be made whenever a new set-up is made. These are checked for alignment, appearance, material loss and weld quality. The action of the machine is carefully observed so that discrepancies in set-up technique can be detected. The results of these checks have been very reliable.

The usual test coupon consists of a weld joining two pieces of tubing, each 6 to 8 in. long and of the proper diam. The usual weld quality check is to load the test coupon to destruction in tension. The coupon must break outside the weld-affected area in order for the set-up to be approved for production parts. These checks are repeated at intervals of not to exceed 2 hr. The results are recorded on the bottom half or back of the set-up card.

As production increased, we noticed greater variation in the dimensions of the unwelded details. For the parts to be usable, steps had to be taken during the flash-welding process to partly compensate for errors made in the preliminary machining. Such compensation must, of course, be in the nature of a deviation from an approved setting; hence a doubt can be raised as to the quality of the weld. This implies a need for some reliable method of inspecting weld quality.

Both magnetic and X-ray inspection have proved accurate only when the weld can be machined free from flash material. Since it is often impossible to clean up the inside of tubular assemblies by machining, extreme caution must therefore be taken when such inspection methods are used in order not to reject sound parts.

Testing by Proof Loading

The problem of inspection has been met fairly satisfactorily by proof loading all parts to which a load can be applied. The manner of loading and the load used are for the exclusive purpose of testing the weld and bear no relationship to the function of the part in the airplane. Sometimes it may be a bending or a torsion load, but most frequently it is a tension load. In any case, the load applied is 60% or less of the minimum ultimate strength which the part would develop if the weld were sound. Although this proof load is usually quite different from the load in service, it is very carefully calculated so that there can be no danger of damage to the parts. Records are kept so that a possible cause of defective welds may be traced by noting where trouble appears most frequently. Our records indicate that from one to five flash welds per thousand normally fail in the proof loading.

Can Attain High Output

The flash-welding production rate is fairly high. Two welds per minute are not exceptional for small parts, while 15 to 20 welds per hour can be expected on the larger parts. This rate gives rise to frequent set-up changes since the number of like parts

Fig. 5—Flash-welded engine mount ring forging in the proof loading jig. Proof loading has so far proved the most practicable method of testing flash welds.

Fig. 6—Completed engine mount assembly. The ring shown was forged and not flash welded.

Fig. 7—Flash welding of hydraulic pistons.

is fairly small—releases of 500 like units would be considered large.

The above condition in aircraft flash-welding is one which will probably always exist. In peacetimes, fewer parts are needed, while in wartimes the amount of material which can be tied up in any one assembly is closely controlled. We believe insufficient attention has been paid to this problem.

Possible Time Savings

In our opinion, much improvement could be made in the methods of holding the clamping dies in place. In our experience, no set of dies has ever been installed in a flash welder without needing some adjustment. Fifty per cent of the entire set-up time could be saved if provision for fast, accurate adjustment of these dies could be incorporated in the machine design, perhaps through arranging a horizontal, a vertical and a swivel adjustment of the entire stationary platen by means of a calibrated worm screw for each. Another 25% saving in set-up time could be accomplished by equipping the machines with precision back stops. These should be designed so that special locating fixtures could be installed in a minimum time and yet be sturdy enough to withstand the full upset pressure. Extreme care in the design of this item is warranted: a clumsy design may limit the usefulness of the machine through interference with the parts to be welded, while inaccurate alignment will not permit holding the required tolerance.

Fittings to Tubing

Most aircraft flash-welding applications are at present on SAE X-4130 (chrome-moly) steel. The majority of the assemblies consists of end fittings welded to tubing. In a few cases, two forgings of irregular section have been welded together, and some promising experimental work has been done with matched steel pressings. But the flash welding of extremely long lengths of sheet stock has been avoided because of the expensive specialized equipment required.

Although it is occasionally necessary to normalize a flash-weld assembly in order to facilitate machining, considerable time is saved by eliminating unnecessary heat treatment and the resultant warpage which such heat treatment causes.

Some assemblies may become hermetically sealed as the result of flash welding. On these, pressure relief holes should be drilled prior to any heat treatment in order to remove any danger of bursting due to internal pressure when heated. Such holes need not be drilled if heat treatment is unnecessary, and no internal protective coating need be applied since the amount of oxygen and water vapor within a hermetically sealed assembly is limited, and corrosion caused from these sources is correspondingly negligible.

Flash-Welded Control Rods

Fig. 2 shows threaded control rods of the type used by the hundreds in aircraft production. Either a 10- or a 20- kva machine can be used satisfactorily for the production of these tubular assemblies. The part is $\frac{3}{8}$ in. OD, 0.035 in. in wall thickness. For welding, a travel of $\frac{3}{16}$ in., including upset, is used; this takes place in approximately one second. A distance of $\frac{3}{16}$ in. separates the moving and fixed clamping dies at the end of the weld cycle. Although SAE X-4130 steel is used, no heat treatment for this assembly is required after welding.

Fig. 3 shows an oil cooler support —an assembly quite similar to the control rods except for the type of end fittings. In welding this assembly, special locating fixtures are attached to the machine in order to hold the rotational relationship of the end fittings.

Motor Mount Applications

Fig. 4 shows the details of a flash-welded engine mount strut of $1\frac{1}{8}$ in. diameter. This assembly consists of

Fig. 8—Landing gear assembly. Seven flash-welded members are used in making up this gear.

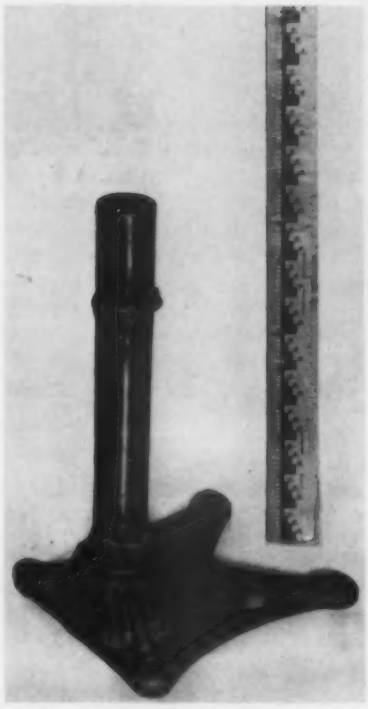


Fig. 9—Flash-welded bracket assembly.

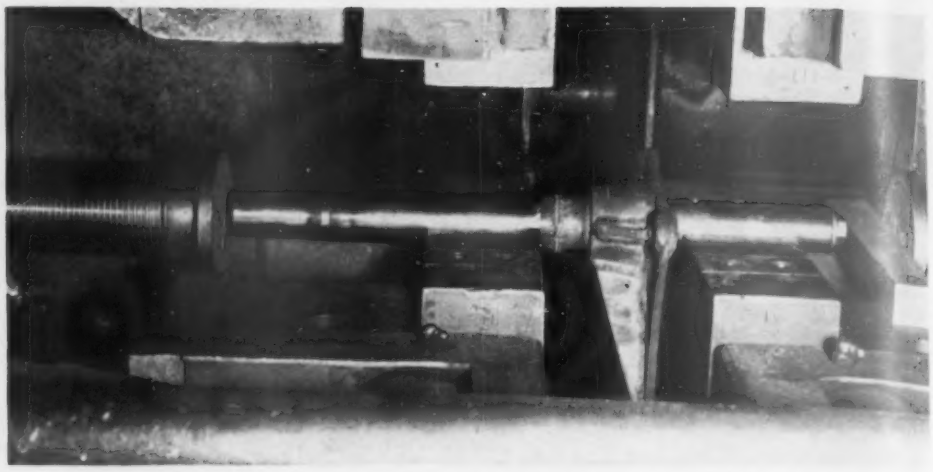


Fig. 10—Bracket assembly shown in Fig. 9 as it appears in the machine just after flash welding.

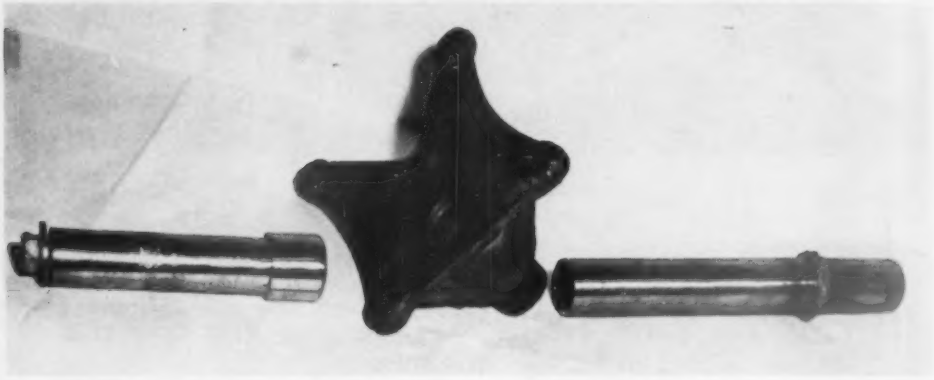


Fig. 11—The copper alloy mandrel at the left solved the clearance problem encountered in the flash welding of the bracket assembly shown in Figs. 9 and 10.

heat-treated SAE X-4130 ends that are flash welded to normalized SAE X-4130 tubing. Fatigue tests have demonstrated that subsequent heat treatment is unnecessary. However, the finish machining is performed after flash welding in order to hold the close tolerance on length and the accurate alignment of the tapped holes which are placed in each end.

Fig. 5 shows a flash-welded engine mount half ring in the jig used for proof loading. In this case, two matching forged sections are welded. Fig. 6 shows the complete engine mount assembly. The forged ring shown in the picture was not flash welded. Difficulties in procurement of the one-piece forging, however, gave rise to the welded construction.

Fig. 7 shows a flash-welding machine in operation. In this case, the part being welded eventually becomes a hydraulic piston assembly. Provision is made for finish machining after welding in order to hold the required tolerance.

Landing Gear Assembly

Fig. 8 shows the landing gear assembly. Seven flash-welded members are used in making up this gear. Because of the strength requirements, all the parts in this case are heat treated after flash welding. In order to hold the close dimensions, the finish machining is done after the heat treatment.

In Fig. 9 is shown a bracket assembly completed except for machining. Fig. 10 shows the assembly in the machine just after the welding has been completed. Note that a mandrel was used to hold the base of the bracket in alignment. This mandrel was of copper alloy and served to carry the welding current. Fig. 11 shows the mandrel, the base plate and the tube on which the end has already been welded. This picture also shows the head of the draw bolt by which the mandrel is expanded after it has been inserted into the hole in the base plate. This particular welding technique is used because of clearance problems on the machine.

Conclusions

It seems advisable to review briefly the exact procedure used for setting up a new flash-weld job. The values given are typical for SAE X-4130 (chrome-moly) steel:

1. Test coupons representing the job are procured. These are cleaned by sandblasting or by pickling in order to provide a good electrical contact.

2. The machine is set-up to give the total travel required for welding. From 20% to 35% of the total travel will be upset travel. The exact values must be determined experimentally.

3. The closed position of the clamping dies for most jobs will be as near together as possible, to aid in maintaining alignment. Space must be left for the upset to form. A minimum value for this is $\frac{3}{16}$ in. for thicknesses under 0.040 in.; for each additional 0.040 in. thickness add $\frac{1}{64}$ in.

4. Adjust the speed and current for steady vigorous flashing. A good preliminary speed setting will cause the flashing travel to take place in a time equal in seconds to about five times the area of a cross-section in square inches.

5. For some parts, particularly those with a wall heavier than $\frac{1}{16}$ in., some benefit may arise from beveling the end of one of the parts. The exact shape of the bevel is not critical. Its purpose is to prevent two perfectly matched machined surfaces from coming into contact and because of their current-carrying capacity preventing flashing from starting.

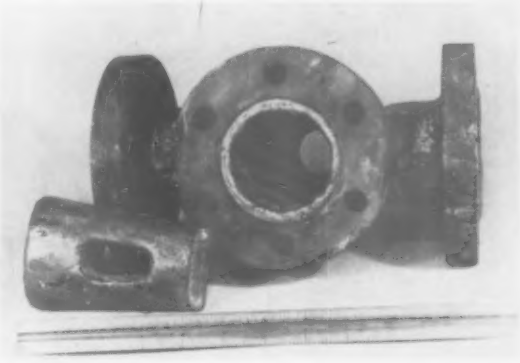
6. Trial welds are made until the external appearance is satisfactory. Some of the welds are then subjected to tensile loads, while others receive metallurgical examination. If the results of these tests are satisfactory, the final setting is recorded on the set-up card, and production can then proceed.

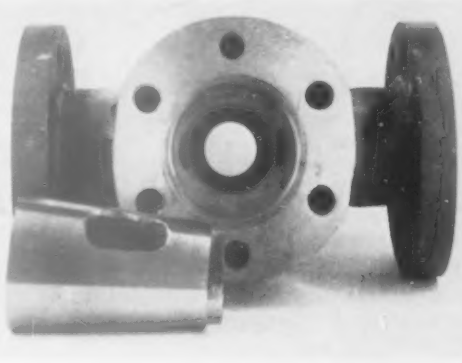
Reclamation by Hard-Facing*

Many machine parts badly needed during the present emergency can be reclaimed at less than the cost of new parts and given greatly increased resistances to wear, abrasion and corrosion.

By **F. G. JONES**

Wall-Colmonoy Corp.





This lubricated plug valve, used in the high-temperature refining of aviation grade gasoline, was reclaimed from the effects of corrosive sulphur compounds in vaporized oils. The pictures show the valve before and after machining. The chromium - boron - nickel hard-facing (non-ferrous) provides resistance to both abrasion and corrosion.

HARD-FACING is the placing of an overlay of metal inherently hard and wear- or corrosion-resistant on a metal part not possessing these qualities or on a part worn or corroded to the point where it may be unserviceable. The overlay may be applied by oxy-acetylene welding, metal arc welding, carbon arc welding or furnace welding.

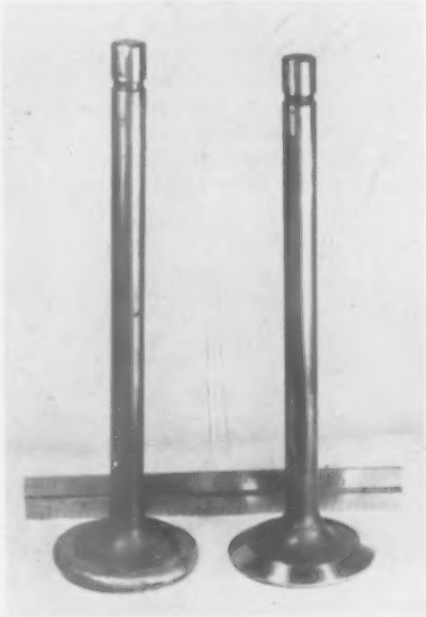
Applications of Each Process

Oxy-acetylene hard-facing is usually done with a standard oxy-acetylene welding outfit, although some manufacturers of welding equipment have designed special tips for applying hard-facings. This method is generally used when applying the non-ferrous hard-facings. Very large parts have been successfully hard-faced by the oxy-acetylene process when properly prepared and handled.

Metal-arc welding is used for applying most ferrous-base hard-facings, as well as for non-ferrous hard-facings in cases where the part was of such size or shape as to be unusually difficult to hard-face by the oxy-acetylene process.

Carbon-arc welding is used on some types of hard-facings which are supplied in paste or powder form. These hard-facings are spread on the part and fused in place with the carbon arc. This method actually forms an alloy of the hard-facing particles and the base metal; it is usually used where the part can be placed in service in the "as-welded" condition.

The various furnace welding and brazing methods are found most suitable for applying hard-facings to small parts or to large quantities of duplicate parts. A casting of hard-facing metal is bonded directly to the part (if the alloy lends itself to this method) or by low-temperature brazing or copper brazing. The method of application of the hard-facing overlay must be determined from the type of hard-facing to be used and the size and number of pieces to be hard-faced.



Tractor valves before and after machining. These valves were reclaimed by non-ferrous hard-facing.

Types and Grades

Various types of hard-facing materials are manufactured for wear resistance, corrosion resistance, impact resistance, resistance to erosion or combinations of these qualities. The various grades are manufactured to suit conditions under which the hard-facing overlay must be put in condition for use. In most cases, the hardest possible grade is chosen, provided it meets the requirements as to type.

Usually, these hard grades must be ground. If the part to be hard-faced is of such a shape or size that it is not practicable to grind it, then a softer grade which can be machined should be chosen. In most cases, the oxy-acetylene deposited, non-ferrous hard-facings offer a greater choice along this line.

Essential Qualities

The various types of hard-facings are alloyed in their various combina-

* *Abstracted from a paper presented at the annual meeting, AWS, Chicago, Oct. 18 to 21.*

These forming rolls were hard-faced with a machinable grade of chromium-boron-nickel hard-facing, which provides resistance to wear yet has a hardness of only 40 Rockwell C.

tions for definite reasons. The non-ferrous alloys, such as the chromium-boron-nickel alloy or the chromium-tungsten-cobalt alloy, are designed for corrosion and wear resistance and resistance to erosion at high temperatures. The ferrous-base hard-facings seem to be less suitable for high-temperature operations but have definite advantages where there are either severe impacts or else a succession of milder impacts along with abrasion.

The main requirements of a hard-facing seem to be that it must have a low coefficient of friction, and that it must not flow under pressure or impact. A low coefficient of expansion is also desirable. The hard-facing need not possess work hardenability, although this, too, is quite desirable for some uses. It should also have a very high resistance to galling against itself or against other materials.

Saving Alloy Steels

The essential use of hard-facings, under the present emergency, is to save our supply of strategic elements. Some of the hard-facings available use no strategic raw materials whatever, and serious consideration should be given to the possibilities of using these types.

Hard-Faced New Parts

Serious study should be devoted to the hard-facing of new parts in view of the present conditions. Many new parts designed of alloy steels in order to secure hardness to resist wear or abrasion could often be made of plain carbon steel and hard-faced where the wear is to occur. Parts which are so hard-faced will usually outwear a hardened steel part many times while using less of the now so urgently needed strategic raw materials.

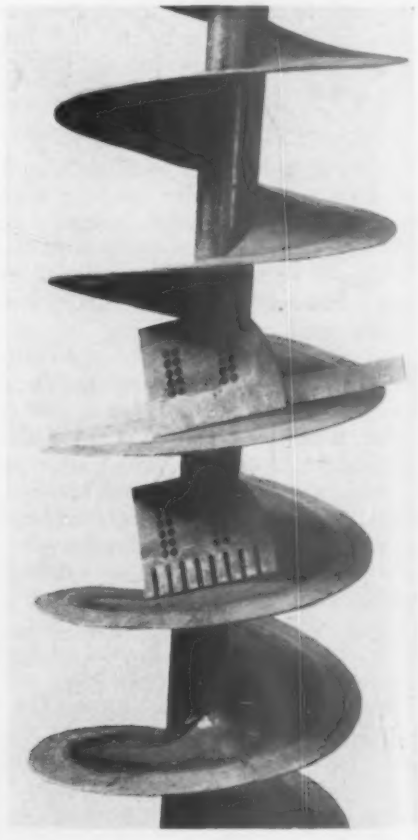
As an example of the value of hard-facing methods for reclamation purposes, one machine part weighing 46 lbs was reclaimed by only 2½ lb of non-ferrous hard-facing material applied by the oxy-acetylene process. To produce a new part, 183 lb of rolled alloy steel plate would have been required.

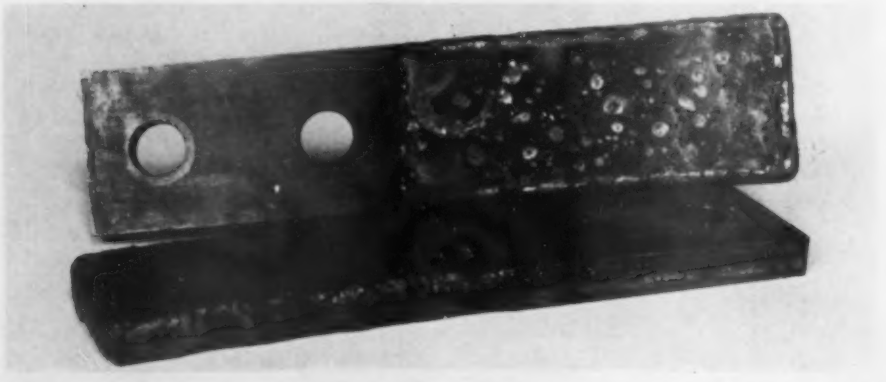
Forming Rolls and Hammers

Rolls forming ¼ in. thick hot-rolled steel plate were made of oil-hardening tool steel and hardened to 65 Rockwell "C" in an attempt to prevent wear. There was considerable breakage. The worn and broken forming rolls were reclaimed with a non-ferrous hard-facing alloy. The latter had a hardness of only 40 Rockwell "C," making it possible to machine the reclaimed rolls. The hard-faced rolls have now operated as long as the hardened steel and without breakage. The reclamation of a roll required from four to six lb of hard-facing alloy, whereas about 70 lb of tool steel would have been required to make a new roll.

Another example of the alloy steel savings made possible by hard-facing is the reclamation of hammer mill hammers pulverizing an asbestos product. These were made of hardened high-speed steel, a material that would operate successfully for only three months. The hammers were hard-faced with ferrous-base hard-facing applied by oxy-acetylene welding, and the reclaimed hammers then

This flight conveyor was hard-faced with a paste that was painted on with a paintbrush and fused with the oxy-acetylene torch. The cutting knives were also hard-faced by the same method.





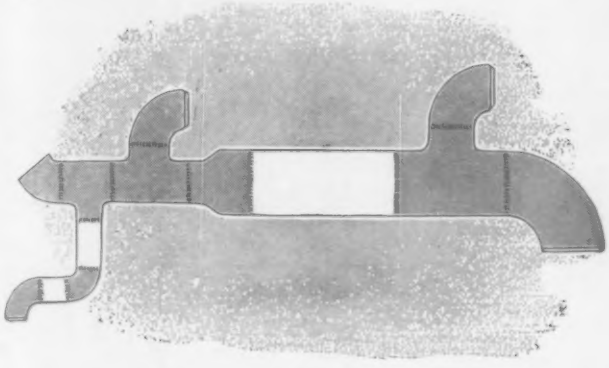
These mild steel sand mixer paddles were hard-faced to prevent wear and used to replace chilled iron paddles in a foundry. The hard-facing was a chromium-boride paste, fused with the carbon arc.

NO. 10 OF A SERIES

HOW TUBE-TURN WELDING FITTINGS BENEFIT WAR INDUSTRY

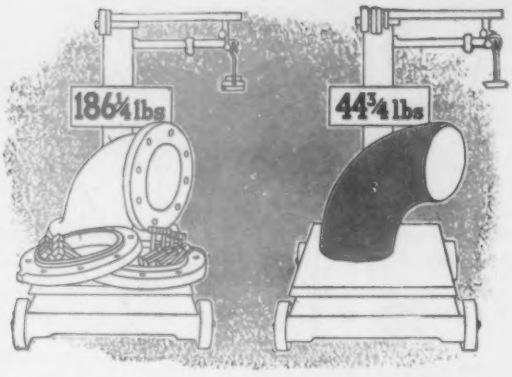
The FIRST SEAMLESS WELDING FITTINGS

Improve industrial piping 4ways with Tube-Turn welding fittings!



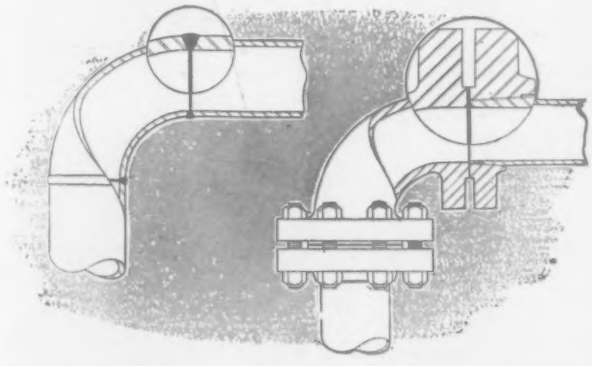
1. Easily preassembled—speed installation

Save from 50% to 75% time by pre-assembling difficult piping sections like this in the shop. Tube-Turn fittings are ready to use. They simplify lining-up, require only easy, circumferential butt welds. This insures faster, better and safer welding by either veteran or novice welders—a real war production help.



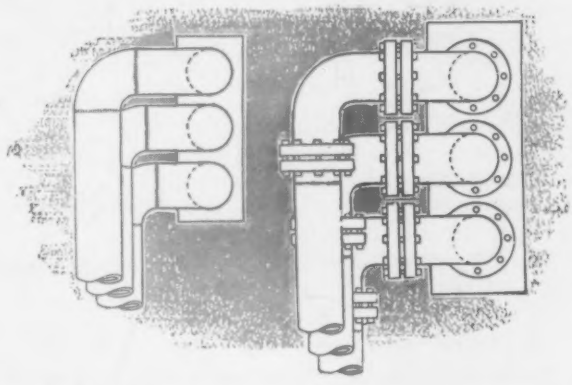
2. Reduce weight—conserve materials

Look at the weight saved by using an 8" Tube-Turn elbow instead of a heavy 8" cast iron flanged ell with companion flanges, studs and nuts. Multiply this saving by the many fittings in any piping system and it's easy to see how Tube-Turn fittings save tons of weight, metal and critical materials.



3. Avoid "down time"—reduce maintenance

Note how the welded connection virtually forms a continuous tube without joints—insures permanently leakproof, trouble-free connections that last as long as the pipe itself! Such maintenance headaches as leaks, gasket changes, bolt tightening, caulking, threading, and difficult insulatings are totally eliminated.



4. Streamline systems—save space

Contrast the space saved in these compound turns by using Tube-Turn elbows instead of flanges. Tube-Turn fittings require less space, permit streamlined, compact layouts and neater, more efficient piping. Elbows can be cut to any odd angle. Saving space is important in most industries, is vital in shipbuilding!

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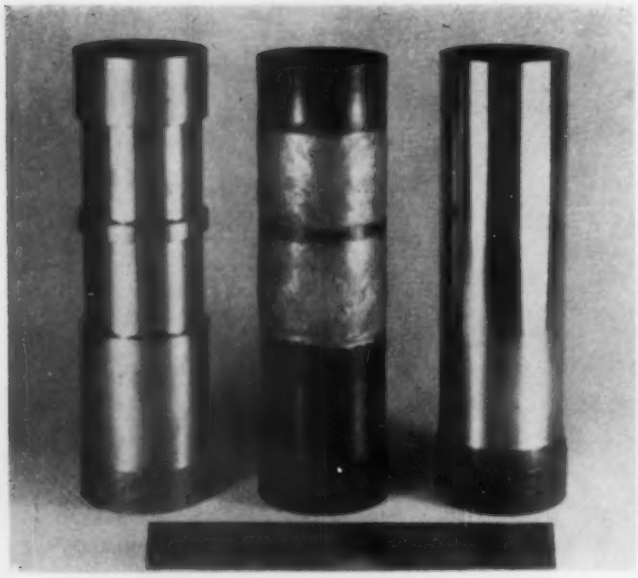


Hard-faced pump sleeves for pumping corrosive boiler solutions. Made of seamless tubing, the hard-faced sleeves replaced solid stainless steel units. The latter lasted only three weeks as against nine months for the more economical hard-faced sleeves. Left to right: blank showing undercut for hard-facing, welded sleeve and sleeve after finish grinding.

lasted six months. Thus a few pounds of hard-facing saved many times their weight in high-speed steel, which certainly is strategic at the present time.

Another example of the reclamation of hammers for hammer mills is that of 39 manganese steel hammers. The carbon-arc process was used to apply six lb of a paste form of hard-facing material which contains no strategic materials. The hammers were then maintained in good condition by applying 1½ lb of the same material—15 applications in all. The hard-faced hammers crushed 158,000 tons of cement rock, whereas the non-hard-faced hammers would crush only 77,000 tons.

Fans, Valves, Pumps

Induced draft boiler feed fans made of alloy steel plate would operate about four months. A paste-type hard-facing, applied by carbon arc, increased the life of these fans to 17 months. The hard-faced fans were of plain carbon steel or boiler plate, and the paste-type hard-facing contained no strategic material.

An example of the use of corrosion-resistant and wear-resistant hard-facing is provided by the large cock valves used in corrosive solutions in oil refining. Valves of corrosion-resistant steel required relapping (to seal them so they would shut off) every six months. Hard-faced with a non-ferrous hard-facing alloy by the oxy-acetylene process, valves of the same type have been in operation over 18 months without relapping. The original corrosion-resistant steel valves are now to be reclaimed with the same hard-facing material.

Turbine-type pumps made of corrosion-resistant iron alloys for use in coke by-product plants were reclaimed with a non-ferrous hard-facing alloy by the oxy-acetylene process; the reclaimed pumps last more than three times as long as the originals.

Die Life Lengthened

Draw dies 15 in. OD by 7¾ in. ID by 3$\frac{1}{32}$ in. thick were hard-faced in 9 hr with 14 lb of non-ferrous hard-facing. These dies were heated to 400 F, and a very thin layer of hard-facing material, known as a tinning coat, was applied by the oxy-acetylene process. The dies were then heated to 1,200 F while the welding progressed until the hard-facing had been built up to a layer $\frac{3}{16}$ in. thick. If the die cooled below a visible red heat, the welding was stopped and the die reheated to the 1,200 F temperature.

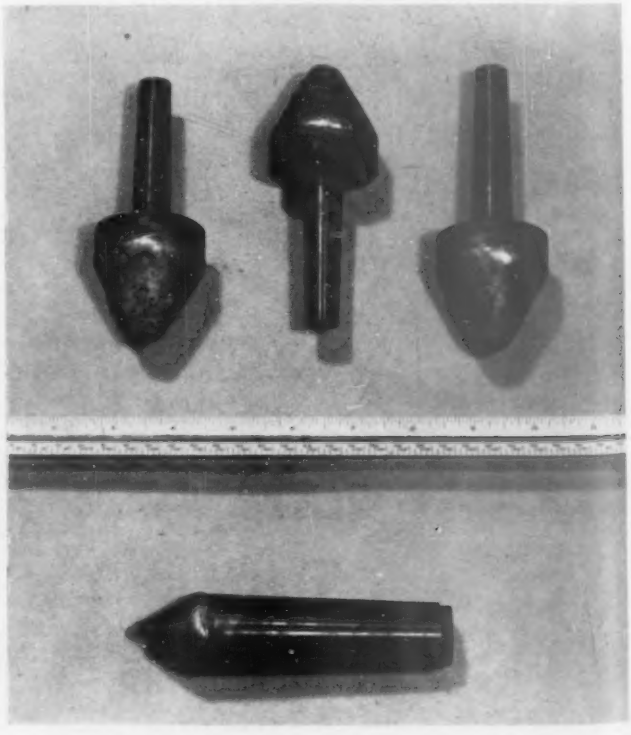
Before hard-facing, hardened tool-steel dies lasted only 30 days and had to be repolished every day. After hard-facing, the dies ran 30 days before repolishing. A hard-faced die put in operation on Dec. 15, 1942, was still operating on Aug. 3, 1943.

Another example is that of a large automobile fender die which was altered at the change of models by the use of a machinable grade of non-ferrous hard-facing. This die was built up at one point to approximately 2 in. thick, the build-up tapering down to nothing in about two feet in each direction. The 50 or so pounds of hard-facing required to do this job saved a new 3,000 lb casting of alloy cast iron, all the machining and the alteration of the pattern, if not a new pattern.

Reclaiming Lathe Centers

Machine parts used in the production of war materials can be reclaimed very easily. To cite one case, a high-speed lathe center was being reground each day. When it had worn too much for further grinding, this center was hard-faced and then ground at the trifling total cost of $2. After hard-facing the center required regrinding only every 21 days.

Many parts other than those previously listed can be reclaimed at a cost not higher than a new part and with the advantage of additional life. It seems quite urgent that each and every user of machine parts should do his best during the present emergency to save strategic materials by expanding the use of hard-facings in every way possible.



Hard-faced, these high-speed lathe centers were able to run for three weeks without grinding. Previously, they had required regrinding every day.

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Fig. 1 — Extreme contrasts of light and darkness in welding areas cause harmful eyestrain and should always be avoided.

Better Light for Welding!

By **JOHN J. NEIDHART**

Engineer, Lighting Division, Westinghouse Electric & Mfg. Co.

It isn't a paradox but a practical need which is not being recognized in all too many welding shops. This article tells what to do in order to obtain optimum lighting efficiency from your present installation.

HIGH levels of proper quality illumination enable war workers to produce more goods with less effort. It might be thought that in the welding shop the brilliant flame or arc would yield all the light needed for any job. True, but the necessity of constantly adjusting the eyes from the glaring arc or flame to the comparative dimness of everything else causes eyestrain which could be minimized by diminishing the contrast. Since weldor's eyes are valuable—as is evidenced by the large quantity of shaded lenses and goggles purchased every year to protect them—proper illumination is as necessary to the welding shop or welding department as anywhere else.

To obtain the best lighting, it is essential that the installation be carefully planned. However, we shall not discuss the design of the lighting installation here but shall see instead how the optimum lighting efficiency of *any* lighting installation may be obtained and maintained.

Fig. 2—A well lighted welding shop. Note how the glare of the torch flames has been minimized by increasing the brightness of the surroundings.

Painting the Surroundings

The efficiency of a given lighting installation is dependent upon: (1) the ability of the surrounding surfaces to reflect light and (2) the maintenance of the lighting equipment. The first of these factors is attained by proper painting.

Ceilings, walls, trusses, columns and machinery may absorb a considerable percentage of the total light if their surfaces are not painted a light color which will cause most of the light striking them to be reflected and so

You can't teach an *Old Dog* new tricks

So says the proverb!

Yet, almost overnight, American shipbuilders—"old dogs" at their business—*learned* the entirely "new trick" of constructing steel cargo vessels and war vessels by welding. If they hadn't, the "bridge of ships" that made the conquest of North Africa and the invasion of Europe possible would still be just a pipe dream.

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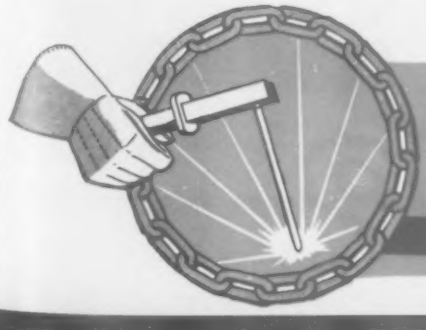

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WELDING ELECTRODES . . . COMMERCIAL CHAINS . . . TIRE CHAINS

Fig. 3—Take down lamps and reflector for cleaning at regular intervals.

increase the amount of light reaching the working plane.*

Before and after checks on the illumination in various factories have proved that the illumination may be increased 100% or more by proper painting alone. An Ohio manufacturer, for example, found that the illumination in his factory was increased from 5 to 15 footcandles merely by repainting all interior surfaces to prevent absorption of light.

What Paint to Choose

Reflectivity: Since high reflection factors lead to high efficiencies, it is very desirable to paint all ceilings, walls, trusses and columns with a paint having a reflectivity of 75% or better (except for a darker wainscot below the working plane). Although it will not be possible to maintain this high reflection factor for an extended period of time in factory areas having a dirty or oily atmosphere, the reflectivity will at all times be higher than it would be if it had been low initially. Furthermore, the reflectivity can always be restored to its initial value by repainting or perhaps merely by washing.

Glossy finishes should always be avoided, for the resulting specular reflections of the light sources will cause annoying glare. A matte finish will provide for greatest diffusion of the light and will completely eliminate specular reflections. However, a semi-matte or egg shell finish is usually more satisfactory since it has a smoother surface which does not collect dirt as easily as the relatively rough surface of a matte finish.

Durability: Since the reflectivity of the paint may eventually be impaired through the collection of dust and dirt, it is advisable to select a moisture-resistant paint which may be washed frequently with soap and water. Special fume and moisture-resisting paint should be employed if the painted surfaces are to be exposed to vapors and gases.

Color: In general, all surfaces except those of machinery should be painted white. White has a higher reflectivity than any color and helps create a bright, cheerful atmosphere. White paints are often tinted slightly with blues or yellows. Tests have indicated that the natural or warm whites depreciate less with age than do the blued whites; slightly blued whites, however, are often the most desirable when used with incandescent lamps or white fluorescent lamps since the blue tint will tend to be color-corrective and provide a more balanced, non-chromatic white light.

Fig. 4—Wash the reflector thoroughly with soap and water.

Machinery may be painted a medium gray; tests have shown, however, that visibility and safety are enhanced by painting the working area of machines a lighter, contrasting color such as buff or cream.

Better Seeing Provided

Proper painting will not only increase the total illumination but will also provide for better diffusion of the light, minimize shadows, reduce harsh shadows and prevent the illumination from dropping off near the walls or around large columns.

Eyes and the Work

When a person shifts his eyes from a bright area to a dark one, his eyes must readapt themselves to the different intensity. The eyes accomplish this by two means: (1) the pupil becomes larger to admit more light, and (2) the retina becomes more sensitive to light. When a worker looks back at his well illuminated work, his eyes must go through this same procedure in reverse. Since most workers look up rather frequently to "rest" their eyes by allowing them to focus on more distant objects, the time-saving value of light surroundings is quite evident.

Research has shown that when the eyes were forced to alternate between two brightnesses, one of which was 100 times greater than the other, 12% less work was done than when the higher brightness was uniform. Furthermore, light surroundings will create a more cheerful atmosphere and improve the morale of the workers. Dark walls and ceilings have the same effect as a dark gloomy day and will tend to be depressing to the people who work within them.

The value of light surroundings assumes particular importance in welding shops and booths where the weldor must look up from the extremely high brightness of an arc or flame. A weldor should never be forced to look up into dark surroundings. If the surroundings are as dark and gloomy as those of Fig. 1, he may experience a temporary blackout for a few moments while his eyes struggle to readapt themselves. When he starts welding again, his eyes must readjust

Fig. 5—And wash each of the lamps thoroughly before replacing.

* In welding booths, the interior surfaces should be painted to absorb excess light and avoid glare —*The Editors.*

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Fig. 7—Removable reflectors make it possible for the maintenance man to remove a dirty reflector and replace it with a clean one that is carried as an extra. He then washes the dirty reflector on the floor and repeats the procedure at the next luminaire, replacing the dirty reflector with the one he has just washed. This saves him one trip up and down the ladder at each luminaire.

themselves to the higher brightness before he can see clearly, and the transition period is lost time that can never be regained. Furthermore, the unnecessary strain and work imposed upon the eyes by such conditions also lead to headaches and defective eyesight.

In the well lighted welding shop shown in Fig. 2 there are no such eye-tiring contrasts.

Lighting Maintenance

The maintenance departments of all factories should devote special attention to the care of lighting installations, for the best 50 footcandle installation may be no better than a 20 footcandle installation if burned out lamps are not replaced and reflectors kept clean. A well-planned maintenance program divides itself into two phases; namely, the cleaning of the lighting equipment and the relamping of luminaires.

The permissible time between cleanings is peculiar to each installation since the rate of decrease in light output varies with the type of lighting equipment and the amount of dust and dirt in the air. The best method of establishing a cleaning schedule for any installation is to make periodic checks of the illumination with a light meter. The length of time required for the illumination to drop to approximately two-thirds of its initial value may be arbitrarily taken as a satisfactory cleaning period in most cases. This period may be as short as three or four weeks in extremely dirty locations, but it will usually be from two to six months under average conditions.

Covers Save Cleanings

Dust-tight covers will simplify the maintenance problem considerably in extremely dirty atmospheres such as are found in foundries and welding shops. In fact, dust-tight covers are essential in welding shops where the lighting equipment is mounted within the range of sparks and flying particles which will pit and permanently damage the reflector surfaces. Heavy-duty dust-tight luminaires equipped with heat-tempered, impact-resisting glass covers are recommended for these installations. Ordinary glass covers will not suffice, for the glass may be broken by the molten particles.

When the luminaires are cleaned, all reflecting surfaces, glass covers and lamps should be thoroughly washed with soap and warm water, Figs. 4 and 5. Merely to wipe off the reflector or glass with a dry cloth is not enough, for this practice is not only inefficient but is also apt to shorten the life of the reflector because the greasy dirt and grime remaining after several dry wipings will tend to form a permanent coating which cannot be removed.

Relamping

The rated life of a lamp is the average life of a large number of lamps and is not indicative of the life of any one lamp. Many lamps will have a much shorter life than the rated hours, and many others will burn longer. The lamps will, therefore, burn out at sporadic intervals with the maximum number of burnouts occuring at or near the rated life.

Lamps may either be replaced as the burnouts occur or on a group replacement plan. The latter plan has the advantage that it may be combined with the cleaning program by arranging the cleaning schedule so that the period between cleanings represents some even multiple of normal lamp life. At the particular cleaning somewhere between 80% and 90% of normal lamp life, the entire installation is relamped, restoring the system to practically its initial efficiency. The old blackened lamps which are close to the end of life may be discarded, but those showing signs of further useful life are set aside to replace the few early burnouts which may occur in the next group of lamps. Such a plan will materially reduce the labor cost of lamp replacement since the additional labor required for relamping the luminaires as they are cleaned will be almost negligible.

Maintenance Methods

In low bay areas, the lighting equipment can usually be maintained from step ladders, but higher bays present more of a problem. In some plants, the fixtures can be cleaned and relamped from a traveling crane, but it is seldom desirable to tie the crane up

Fig. 6 — Lowering a luminaire to the floor for cleaning is quickly accomplished with the aid of an automatic disconnecting hanger in this high bay area.

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With the Wilson "Bumblebee" AC welder you can increase daily welding output by 15% to as high as 36%! Why? Because the "Bumblebee" virtually eliminates "arc blow", thus permitting the use of higher currents with each diameter of electrode. As a result, welding speed is materially increased, and the quality of weld deposits is noticeably improved.

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The "Bumblebee" is made in 300 and 500 ampere sizes. A convenient, easy-turning hand wheel provides an unlimited number of current settings throughout the "Bumblebee's" wide welding range. Other Wilson AC welders are available in sizes from 100 to 1000 amps. capacity. Write for complete details.

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AWS Filler Metal Spec. E6011

Navy Bureau of Ships, Spec. 46E3, Grade III, Class I

A.S.M.E. Boiler Code, Paragraph U68

American Bureau of Shipping

Wilson 530 is available in 1/8", 5/32" and 3/16" diameters, 14" length.

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for this work. Movable telescoping platform lifts are very satisfactory in areas where the presence of machinery does not interfere with their use. Catwalks provide a convenient means of access to the luminaires, but the installation cost is high and they are feasible only for special applications where all of the fixtures may be mounted on a few catwalks. A monorail system provides another quick and easy method of servicing the lighting equipment from traveling platforms or cars and is frequently used for large fluorescent installations.

Automatic disconnecting hangers (Fig. 6) which permit the luminaires to be lowered to the floor by a chain or rope and easily removable reflectors usually simplify the maintenance problem considerably. The reflectors may be washed by one man on the floor or platform while a fellow worker replaces the dirty reflectors with clean ones. Or one man may do the whole job as told in the caption to Fig. 7.

Maintenance Results

The importance of regular servicing of lighting equipment is strikingly illustrated by the results of tests conducted to determine the actual loss in illumination due to the collection of dirt on lamps and luminaires. In one case, a porcelain-enameled reflector for a fluorescent luminaire was removed from an average factory area and tested for light output during the various stages of cleaning. The results were as follows:

Dirty reflector and dirty lamps—
22.8% decrease in light output
Dirty reflector and clean lamps—
18.1% decrease in light output
Reflector wiped with dry cloth—
6.2% decrease in light output
Reflector and lamps washed—
0% decrease in light output

Another laboratory test on two high bay reflectors (which had not been cleaned for over a year) yielded the following results:

(*a*) Open high bay reflector from average factory area:

As found—
42% decrease in light output
Dry wiped—
35% decrease in light output
Washed clean—
0% decrease in light output

(*b*) Enclosed dust-tight high bay reflector from foundry:

As found—
7% decrease in light output
Dry wiped—
5% decrease in light output
Washed clean—
0% decrease in light output

These tests not only illustrate how much light may be wasted through neglect but also show two other interesting points. First, it is evident that dry wiping is entirely unsatisfactory for cleaning. The degree of effectiveness of dry wiping depends upon the character and oiliness of the dirt and the nature of the reflecting surface, but in no case is it adequate. Secondly, the comparison between (*a*) and (*b*) proves the economy of dust-tight covers in extremely dirty locations, for (*b*) was in a much dirtier atmosphere than (*a*). In any case, it is obvious that it pays to keep *lighting equipment clean!*

★

New NE Steel Substitutes

Conditions surrounding production of alloy steels have made necessary certain changes in the chemical compositions of National Emergency (NE) steels, according to recent revisions of the American Iron and Steel Institute. The Welding Engineer's Engineering Data Sheet No. 37 (page 79, October, 1943) gave the analyses of the revised alloy steels which will be available. The table below now supplements that information by giving one or two possible alloy compositions to replace each of the standard AISI and SAE steels that have been heretofore in general use.

STANDARD SERIES DESIGNATION				POSSIBLE	ALTERNATES
1942 AISI Number	1941 AISI Number	1942 SAE Number	1941 SAE Number	NE Number	NE Number
A 1320	A 1321	1320	....	NE 8620	
A 1330	A 1330	1330	1330	NE 8630	
A 1340	A 1340	1340	1340	NE 8640	
A 2317	A 2317	2317	2315	NE 9420	NE 8620
A 2330	A 2330	2330	2330	NE 1330	NE 8630
A 2335	A 2335	....	....	NE 1340	NE 8635
A 2340	A 2340	2340	2340	NE 1345	NE 8645
A 2345	....	2345	2345	NE 1345	NE 8645
A 2515	A 2514	2515	2515	NE 8720	NE 9422
A 3045	A 3045	....	....	NE 1345	NE 9440
A 3120	A 3120	3120	3120	NE 8620	NE 9420
A 3130	A 3130	3130	3130	NE 1330	NE 8630
A 3135	A 3135	3135	3135	NE 1335	NE 8630
A 3140	A 3140	3140	3140	NE 1345	NE 8640
A 3141	A 3141	3141	X3140	NE 1345	NE 9442
A 3145	A 3145	3145	3145	NE 1350	NE 8645
A 3150	A 3150	3150	3150	NE 8650	NE 9450
A 3240	A 3240	3240	3240	NE 1345	NE 9442
A 4119	A 4119	4119	....	NE 9420	NE 8720
A 4130	A 4130	4130	X4130	NE 1330	NE 8630
A 4137	A 4137	4137	....	NE 1340	NE 8637
A 4142	A 4142	....	....	NE 1345	NE 9442
A 4145	....	4145	....	NE 1350	NE 9445
A 4150	....	4150	4150	NE 8650	NE 9450
A 4320	A 4320	4320	4320	NE 8720	NE 9420
A 4340	....	4340	X4340	NE 9540	NE 8640
A 4620	A 4620	4620	4620	NE 9420	NE 8620
A 4640	....	4640	4640	NE 1340	NE 8640
A 4645	....	....	....	NE 1345	NE 9440
A 4820	A 4821	4820	4820	NE 8720	NE 9420
A 5120	A 5120	5120	5120	NE 9420	
A 5130	A 5130	....	....	NE 1330	NE 9430
A 5140	....	5140	5140	NE 1340	NE 9435
A 5145	A 5145	....	....	NE 1345	NE 9640
A 5150	A 5152	5150	5150	NE 1350	NE 8650
A 6120	A 6120	....	....	NE 9420	NE 8620
A 6130	....	6130	....	NE 1330	NE 9430
A 6145	....	....	....	NE 1345	NE 9440
A 6150	....	6150	6150	NE 1350	NE 9445

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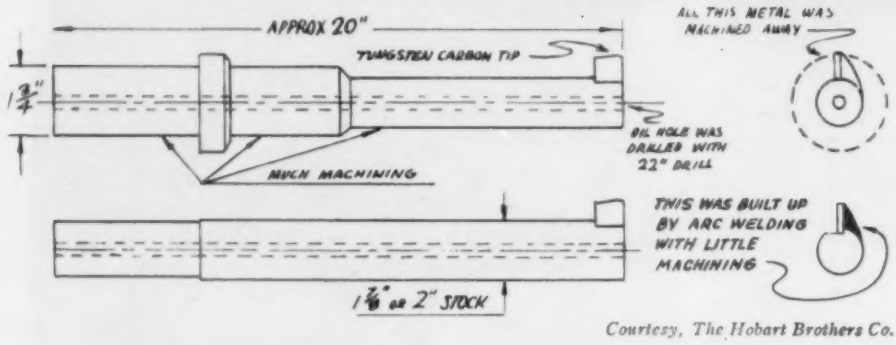
On the Job

Welded Boring Bar

By R. W. CRIPE

GLADDEN PRODUCTS, INC., Glendale, Calif., has found it necessary to redesign many of the tools used in boring landing gear struts for airplanes in order to save valuable machine time. The accompanying drawing illustrates a typical example: the old and new methods of making a boring bar.


APPROX 20"
TUNGSTEN CARBIDE TIP
1 3/4"
OIL HOLE WAS DRILLED WITH 22" DRILL
MUCH MACHINING
ALL THIS METAL WAS MACHINED AWAY
THIS WAS BUILT UP BY ARC WELDING WITH LITTLE MACHINING
1 7/8" or 2" STOCK

Courtesy, The Hobart Brothers Co.

Top: old method of making a boring bar for aircraft tooling. The solid stock had to be drilled and machined for the cutting tip. Bottom: the new method—thick-walled tubing built up by arc welding. Little machining is needed.

The bar was formerly made of solid stock and drilled with a 22 in. drill for the oil hole. Much time was consumed in drilling and in the large amount of machining necessary to provide clearance for the cutting tip. In the new design, the use of 1⅞ in. or 2 in. thick-walled tubing renders oil-hole drilling unnecessary, and the cutting tip seat is built up by arc welding, using tool steel electrodes. Hence very little machining is required by this new method, shown in the bottom illustration.

Under the old method, the cost of the boring bars amounted to approximately $100 each. The new bar costs only $20. The savings represented by use of the thick-walled tubing and welded cutting tip seat amount to approximately 15 lb of metal, 8 man-hours and 6 hours of machine time.

Gladden Products is now using arc welding for the manufacture of hundreds of such types of tools employed on other machining operations.

» «

Copper-Saving Electrode

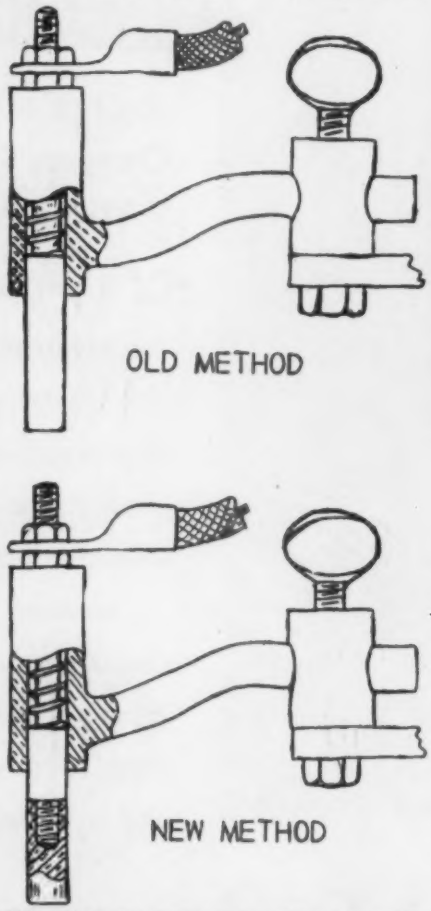
By JOHN STEPHENSON

Lam Div., Westinghouse Electric and Mfg. Co.

IT IS no news to the readers of this publication that spot welding electrodes become worn and "mushroomed" with use and so have to be redressed. Eventually, the time comes when there is not sufficient material to allow for the restoration of the original contours.

When this sad hour arrives, the usual practice is to take the whole electrode from the holder and replace it with a new one. However, this waste of strategic copper is not necessary, as the accompanying sketch shows. A slight change in the design of the electrode will save everything but the worn tip.

The change consists of making the electrode a bit shorter and threading its end for a mating tip having a tapped hole. Then the tip is simply screwed into place and may be as simply unscrewed and discarded when it is no longer serviceable. Thus only a short length of copper need be scrapped, and the electrode proper will remain in usable condition indefinitely.



Old method: the entire spot welding electrode is discarded when the tip is worn out. New method: only the tip needs to be scrapped. The removable tip has a tapped hole to mate with threaded end of the longer electrode section.

» «

Revolving Tool Rack

By CHARLES C. LYNDE

ON CONSTRUCTION jobs at oil-well drilling sites and other locations where deep mud is encountered, many tools are lost for lack of a proper means to hold them between jobs. The weldor for one drilling contractor ended this annoyance by constructing the revolving tool rack shown in the picture.

Tool suspension rack for oil-well drilling sites. The wheel may be revolved to present the unit desired.

An old valve wheel was first welded to a short stub of 1½ in. pipe. To the rim at short intervals were tacked short lengths of chain, each terminating in a hook formed from ½ in. rounds. On location, the rack is supported in a section of 2 in. pipe, which is driven into the ground close to the point of use. The hand wheel is quickly rotated on its bearing of 1½ in. pipe to present the wrench, socket or other hand tool desired. Furthermore, a single quick glance will show whether or not any tool is missing.

This welded suspension rack has the additional advantages of allowing muddy or oil-covered tools to be hosed clean and permitting quick inspection of the condition of wrench jaws, sockets and other parts.

OXYGEN To Make Them
OXYGEN To Keep Them Rolling

Photo by U. S. Army Signal Corps

☆ And Meco Safe-T-Chek Oxygen Regulators are serving on the battle front as well as the production front

Oxy-acetylene cutting and welding processes play a vital part in the production of armored equipment—a still *more* vital part in repair and maintenance of this equipment up behind the battle lines.

Meco Safe-T-Chek Regulators are faithfully performing their war duties wherever the safe—efficient control of Oxygen is required. The four-seat construction provides for three "spare" replacement seats—self-contained in the regulator—an extremely valuable feature where time is the vital factor.

Let us give you all of the details of Meco Safe-T-Chek Construction and Performance.

Meco

WELDING AND CUTTING EQUIPMENT

MODERN ENGINEERING CO.

3413 PINE BOULEVARD ST. LOUIS, MISSOURI

Fractured 14,000-Pound Mantle *Salvaged by Amsco Conservation Welding . . .*

A fracture 28″ in length developed in a 14,000-pound manganese steel crusher mantle in a large limestone crushing plant. Either a new casting had to be ordered, which might take months to obtain, with the possibility of complete shutdown in the meantime; or the cracked mantle must be repaired by welding. The company's welders were dubious, as the metal section was approximately 3½″ thick.

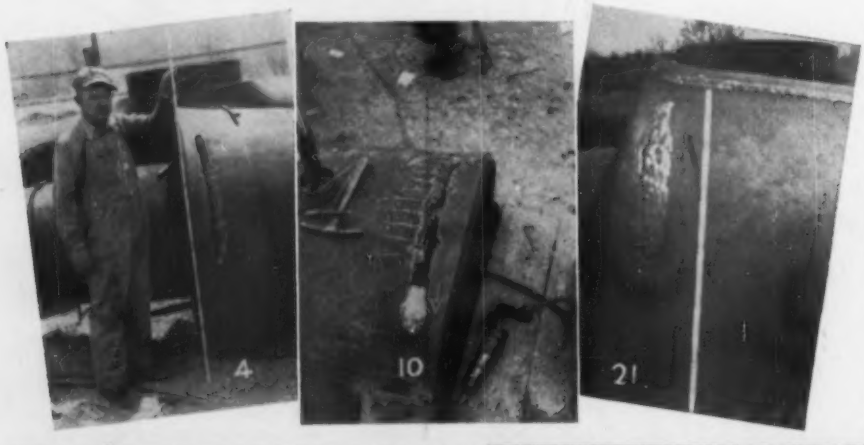
Knowing that Amsco manufactured welding materials, as well as crusher parts, the company called on us for advice. Inspection indicated that the crack in the mantle, which was not of Amsco manufacture, was due not to any operating fault but to foundry defects.

The defective metal was burned out and the area cleaned of scale as shown in Picture #4. Amsco Nickel-Manganese Steel Welding Rod was applied, 2″ steps being welded at a time; the operator working from the ends of the crack toward the center. Picture #10 shows the work in progress, with a pneumatic air hammer at hand in order to peen each deposit thoroughly. This stress-relieving measure is important in the welding of manganese steel.

After the fracture was completely welded, corrugations were formed on the mantle for greater efficiency in handling large rock. ⅜″ Amsco Nickel-Manganese Steel Filler Bars were applied longitudinally and filled in along the sides with Amsco Nickel-Manganese Steel electrodes. Two layers of Economy Hardface were deposited on top of the corrugations. This coating has a Brinell hardness of 450-550, and takes the initial wear while allowing the manganese steel underneath to work-harden. Picture #21 shows the crack completely welded, and one of the corrugations.

The cost of reclaiming this casting was much less than the cost of a new mantle, and 14,000 pounds of casting metal were saved.

Ask for Bulletin 941-W on Amsco Welding Products.



Amsco
AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Illinois
FOUNDRIES AT CHICAGO HEIGHTS, ILL.; NEW CASTLE, DEL.; DENVER, COLO.; OAKLAND, CALIF.; LOS ANGELES, CALIF.; ST. LOUIS, MO.
OFFICES IN PRINCIPAL CITIES

AMERICAN Brake Shoe COMPANY

Spot Welded Superchargers

THE TURBOSUPERCHARGER, the engine accessory that enables our fighting aircraft to surpass those of all other nations in high-altitude performance, is subjected to such extreme operating conditions that its manufacture requires a great deal of high-precision work. The supercharger impeller is exposed to temperatures which may sink as low as 67 below zero while only 18 in. away the turbine wheel is being driven by hot exhaust gases at a temperature of around 1,500 F. Both elements revolve at speeds of more than 20,000 rpm and require exceptionally close clearances.

Spot welding an aircraft turbosupercharger part at General Electric's Fort Wayne, Ind., plant. This is delicate work, requiring close tolerance.

Prior to the war, when production was small, a small staff of expert mechanics tailor-made the complete unit, and it was naturally believed that production methods could never be adopted. However, turbosuperchargers are today being turned out on an assembly-line basis at General Electric's Fort Wayne, Ind., plant—without any sacrifice of the precision and attention to exceptionally close limits that was early found necessary.

Much of the work of assembly is now being done by women. As the superchargers move down a long assembly line, each girl worker adds a part or performs a particular operation. To aid in the work of assembly, the parts to be added are contained in the drawers of the box on which each supercharger is mounted. The larger parts "flow" along another movable track to the rear of each worker. When the superchargers reach the end of the movable track, they have been completely assembled and are ready for their final inspection.

The accompanying picture shows one highly important step in the assembly—the "stitching" of supercharger parts with an electronically controlled spot welder. Without the speed and precision of resistance welding, it would be impossible to maintain assembly-line production of these vital aircraft accessories

Now look who's OK'ing *pipe welds!*

YES, a chemist. And he's just one of the many new people whose approval your welding jobs may need. Weldments these days are judged by complicated standards—chemical or electrical as well as mechanical.

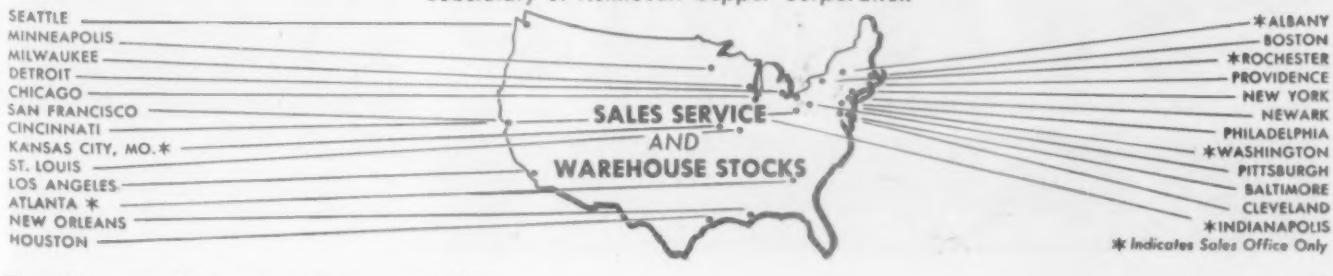
Take Red Brass pipe joints, for instance. Here strength and soundness aren't enough for a service-worthy weld. The joint must resist *dezincification* as successfully as the parent metal. Yellow brass welding rods don't do the trick—but high-copper, low-silicon rods get the green light from chemists.

Perhaps *you* are running into new service requirements like this—factors that influence the planning of your jobs. It may pay you to check your welding rod selections and methods with men who know the copper alloys from *every* service angle. Just call the nearest Chase Sales Service Office. They have the answers to your welding questions—or will get them quickly from the Chase headquarters.

CHASE

CHASE BRASS & COPPER CO. *Incorporated,* **WATERBURY, CONNECTICUT**

Subsidiary of Kennecott Copper Corporation



"Trail-Blazing" Arc Path

A HIGH voltage arc stabilizer has been developed by the Sharon Transformer Div. of the Westinghouse Electric and Mfg. Co. to facilitate arc welding of the delicate aluminum and alloy steels used in warplane construction. The device, a complicated assembly of coils, condensers and transformers, includes also a spark gap oscillator—that standby of radio transmitters in the old crystal set era. It is said to be able to permit the welding of planes to be speeded up from six to 12 times.

Though the construction of the stabilizer is somewhat complicated, the principles upon which it operates are fairly simple. It produces high voltage, high frequency current which changes its direction of flow many thousands of times a second. This type of current has the ability to leap through the air from the tip of the welding rod to the metal being welded. While making this journey, it knocks off electrons from the atoms of gas in the air. When the air is in this ionized condition, it conducts electricity more easily. Thus the regular welding current can readily follow the path created by the "trail blazer."

Until the new stabilizer was developed, low currents had to be used to prevent burning of the thin-walled alloy tubing and thin sheet metal used in plane fuselages, engine mounts and other aircraft parts. The rods employed are often as thin as a pipe-cleaner, and the arc itself is about the size of the head of a safety match. Under these conditions, the arc tended to go out each time the welding current changed its direction of flow. Hence only highly skilled operators were able to do airplane arc welding. With the new stabilizer, however, it is claimed that even newly trained employees can arc weld thin alloy tubing and sheet metal successfully.

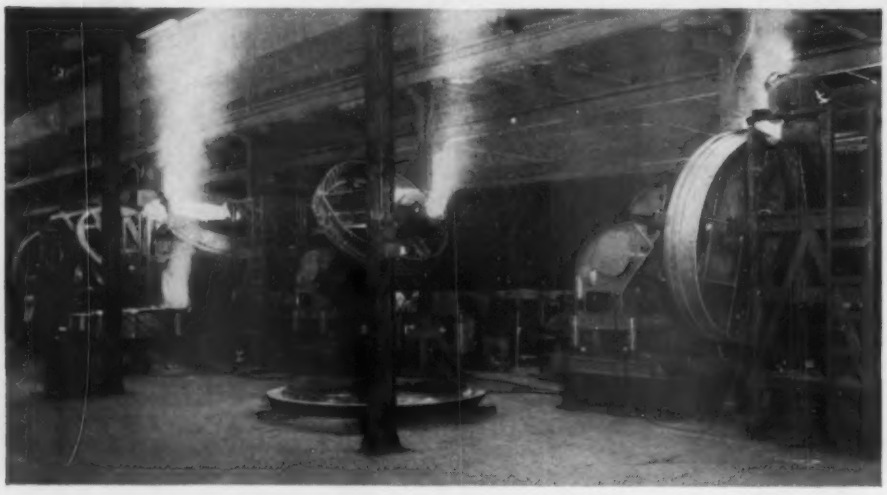
The stabilizer was developed by C. L. Denault, engineer at the Westinghouse Sharon plant, with the assistance of William E. Pakala, engineer of the East Pittsburgh plant. After several experimental stabilizers had been successfully tested on the production lines of an Eastern aircraft plant, the Sharon works undertook production of the new device, which is now being built into A-C welders.

A newly developed high voltage, high frequency arc stabilizer is said to "blaze" an electrical path through the air and prevent extinguishment of the match-head-size arc needed for aircraft welding. One of the inventors, Westinghouse Engineer William E. Pakala, is shown here as he tests a laboratory model of the new device.

» «

Grinding Engine Hood Seams

Sparks fly from their portable grinding wheels as these operators finish smooth weld seams of fabricated engine hoods for two Diesel-electric locomotives in manufacture at General Electric's Erie Works.



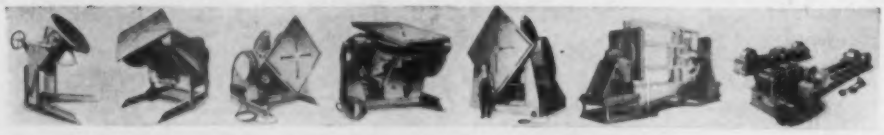
WELDING PRODUCTION GOES UP WHEN RANSOME POSITIONERS GO IN . . .

This statement is no empty claim. It is the summing up of results obtained by plants in every field of metal fabrication.

For Ransome Positioners really put welders and equipment to work at their top effectiveness. There's no waiting for crane service, no waste of priceless human energy. Each welder shifts his work independently and without effort. With a downhand position for every weld, larger rods can be used, which greatly reduces the cost per pound of deposited metal.

And welding *quality* goes up too. Here again, the downhand position pays off in stronger, cleaner, and more uniform welds.

To get the whole story . . . *write for new Bulletin*



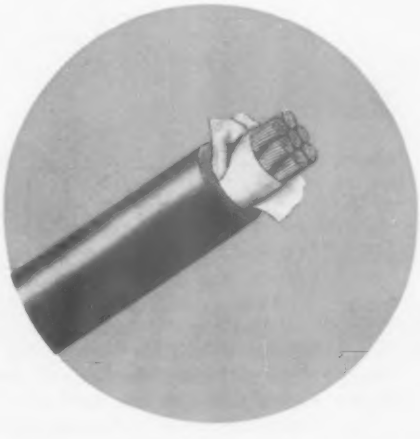
Capacities 500-lb. to 40,000-lb., hand and motor-operated . . . Head-stocks and Tail-stocks . . . Turning Rolls

RANSOME MACHINERY COMPANY

Ransome WELDING POSITIONERS

When the Navy calls for more Submarines,

YOU DON'T SPARE THE WELDING CABLE



● Belden Arc Welding Cables are specially designed to meet the requirements of high-speed war production. Durability for long service and great flexibility for ease of handling are provided by the carefully balanced constructions of conductor and insulation.

With submarines a vital factor in our seven-ocean war, the Navy urges continued speed-ups in submarine production. And, with welding operations an essential step in such production, welding cable plays an important part.

The Navy* uses Belden cables in a number of electrical welding operations in Navy Yards. Belden Welding Cable, highly flexible and with tough insulation that stands up in long service over hot steel plates, makes welding easier and reduces weldor's fatigue. Long-lived, it helps prevent expensive time losses caused by frequent cable replacements.

Belden Manufacturing Company
4677-A W. Van Buren St., Chicago 44, Illinois

**This does not constitute an endorsement by the Navy, as it is contrary to the Navy's practice to endorse any manufacturer's products.*

Belden
Welding **CABLE**

Awarded the U. S. Treasury Special Citation of Merit for initiating the War Bond-or-Cash Dividend Plan

■ **Pulmonary diseases do not always strike quickly. Often they wait two, five or even fifteen years from the time of exposure.**

Willson has long studied occupational diseases—and the dusts which produce them. And the many respirators which Willson has designed to *protect* against these dusts have won the confidence of safety executives all over the world.

All Willson protection is scientifically engineered to provide the utmost in safety and comfort. That is why so many Safety Directors and Purchasing Agents specify Willson for head, eye and lung protective products. For over 73 years Willson has been a leader in the field of accident prevention.

WILLSON RESPIRATOR NO. 5
has U. S. Bureau of Mines approval for protection against inhalations of pneumoconiosis- (silicosis-, and asbestosis-) producing dusts

GOGGLES • GAS MASKS • HELMETS • RESPIRATORS

DOUBLE WILLSON
PRODUCTS INCORPORATED
READING, PA. U.S.A.

Flame-Cut Press Stand

By H. F. BERG
Manager, DeBourgh Mfg. Co.

THE PRESS STAND shown in the illustration below was made of a single piece of ¼ in. plate, flame-cut to shape and bent like a flat sheet of cardboard being folded into a paper box. As a final step, the four mitred corners were welded. It would be difficult to imagine a simpler procedure than this, yet it produces a rigid stand, serviceable and pleasing in appearance.

Courtesy, Air Reduction Sales Co.

One-piece press stand after welding. This stand is formed from one of the flame-cut plates stacked in the background.

To turn out these stands in quantity, production flame-cutting was necessary. For this, a preliminary template was first laid out on 16 gauge steel and cut to shape by shearing. This was mounted on ½ in. studs to provide clearance from the work table and used as a master for the flame-cutting of a working template from ⅜ in. plate. The latter template, heavy enough to offer attraction to the magnetic tracing device employed in quantity production, was then clamped to the work table of a planograph-type cutting machine.

The production cutting of the ¼ in. plate from which the press stands were formed was done with high-speed cutting tips at the unusually high average rate of 35 in. per min. Each piece required 23 lineal feet of cutting and involved eight separate starts.

Four bends on a power bending brake brought the flat plate into its final shape. The monolithic structure was then completed by the welding of four simple mitre joints between the end apron and legs on both ends.

» «

Welding Goes to Jail

THE NEW city hall at Sparks, Nev., was close to completion before the all-steel jail incorporated in the plans had been delivered. When the jail finally did arrive, Chief of Police A. J. Bassemier was in a quandary. How could the jail be put in place without having to tear part of the new building down?

Courtesy, The Hobart Brothers Co.

Students of the Sparks Welding School and the all-steel jail which they dismantled and reassembled inside the new city hall.

The jail had been originally constructed by arc welding, reasoned Chief Bassemier, so why couldn't it be cut up into sections and reassembled by the same process? Weldors? Wasn't there a welding school in town? Maybe the students would like a little practice work.

David E. Williams, instructor at the Sparks Welding School, got his students together, and they took their arc welder down to the city hall as well as necessary equipment for cutting. The flat steel sheets forming the ceiling of the jail were easily cut apart and welded into position inside the building. Next the bars and doors were welded in their proper places. As added precaution against jail breaks, Chief Bassemier had the students weld all the bolts and nuts, too.

The entire job was completed in 25 hours of welding time and 5 hours of cutting time. The only cost to the City of Sparks was for the 150 lb of ⅛ and 5/32 in. electrodes used.

» «

Light Guides Welding

AMONG suggestions submitted to War Production Drive Headquarters by Labor-Management committees in war plants was a highly ingenious light-guide fixture to facilitate the control of submerged melt welding. The light is projected through a narrow slit in a tripod lens and when the beam is directly on the joint ahead of the electrode, the operator can know that the joint is exactly in the center of the weld. Installation of this guide, it is claimed, makes possible the automatic welding of parts which formerly had to be welded by hand and also permits more accurate welding in the dark recesses of shipholds.

The idea was worked out jointly by four workers of the Yellow Truck & Coach Mfg. Co., Pontiac, Mich.

A mite 'grey' around the temples . . . but spry as the day she was delivered!

● We, affectionately, call her Bessy . . . and she'll be 22 come "green up" time in the spring. Which ain't old for trees or mortgages or elephants. But which for bangtails, acetylene generators or mountain gals ain't young either. *But her capacity and willingness for an honest day's work continue unabated.* She's as spry as the day she came off the production line at West Alexandria . . . and the man who owns her wouldn't swap for our latest model. There's a satisfaction in building this kind of a product and a joy in having the kind of friendships it brings.

THE SIGHT FEED GENERATOR COMPANY
Sales: Richmond, Indiana • Factory: W. Alexandria, Ohio

Type **BX** (Patented)

Comfortable to wear, it provides adequate protection, ample ventilation. Opaque side protectors. Multiple adjustment. Federal Specification Lens held securely in place in durable retainer. Manufacture in larger volume has resulted in 16⅔% price reduction. Contact your dealer or write us for folder.

Use this JACKSON EYESHIELD on gas welding and cutting jobs

- buy it at a new low price

NOW $3.75

JACKSON PRODUCTS

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In Canada: C. H. Henze Co., Windsor; Hollup Corporation, Limited, Toronto; Leavitt Safety Appliances Co., Toronto; Paragon Supplies, Limited, Vancouver; Flecks Bros. Limited, Vancouver.

Ten Commandments for Motors

ELECTRIC motors are the muscles of industry, and if they are regularly serviced they will give dependable, long-time operation. But neglect leads to breakdowns —with consequent interruptions in production. To keep motors running with a minimum of trouble and a maximum of safety, the following ten commandments of motor maintenance should always be observed:

I. Open-type motors should be blown out weekly; daily, if the motor operates under severe conditions. Use no more than 50 lb of pressure to avoid possible damage to insulation.

II. Follow manufacturer's instructions when lubricating motors. Too much oil is as bad as too little, causing deterioration of insulation.

III. Inspect bearings weekly or oftener. Feel temperatures, examine for excessive end play and make certain oil rings are working.

IV. Inspect brushes and commutators weekly or oftener. Make certain brushes are seated perfectly and commutators are smooth. Use proper grade of carbon brushes to prevent wear of commutator and reduce sparking.

V. Where motors operate with excessive belt tension, check the air gap between rotor and stator every week. A monthly check of motors in average use is sufficient. Difference in the width of the gap around the circumference of the rotor will indicate extent of wear on bearings.

VI. Where motor leads are exposed to view, check them weekly to see that connections are tight, well insulated and protected, free from oil.

VII. Inspect ground connections weekly to see that they are kept tight and in good condition. This is for the protection of employees and for the proper operation of over-current protective devices.

VIII. Set up a regular schedule for overhauling motors. Most motors should be overhauled annually; those in severe use, however, should be overhauled twice a year or oftener.

IX. Dismantle the motor for a complete overhaul job. Wash all parts with carbon tetrachloride or some other safety solvent. Paint the windings with a good oil-resisting insulating varnish.

X. To prevent fire, keep the area around the motor as clean as the motor itself. Arcing frequently ignites oily material that has not been cleaned up.

» «

Welded-in Drip Pan

By CHARLES C. LYNDE

A LUBRICATOR had been mounted directly over the steam manifold of a drilling engine to provide short leads for oil. Though this simplified the piping, it caused a smoke nuisance every time the lubricator was overflowed while being filled. The weldor for the drilling contractor was asked to design a drip pan that would avoid this trouble.

This welded drip pan is of ample size to catch any spilled oil, and it enables the detection of a leak in the lubricator system before it can attain serious proportions.

The two brackets carrying the lubricator on the upper manifold branch were first cut with a torch, leaving two horizontal stubs. To these, there was welded a steel drip pan, 16 by 24 in. in area with sides ½ in. high. The lubricator was then spotted in this pan, directly over its former supports, and welded to the pan as shown in the accompanying picture.

This design required only two pairs of simple welds as compared with the seams and fitting which would have been required had the weldor attempted to build a pan around the lubricator — the instructions originally issued to him.

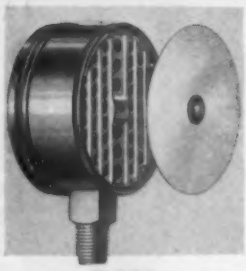
MOTO METER
PRESSURE
GAUGES

MOTO METER Pressure Gauges are designed to permit most effective and economical use of oxy-acetylene flame processes. Their sensitive pointers and clearly legible dials provide pressure facts that help to insure proper welds and clean cuts.

. . . make possible correct pressures for each operation.

. . . aid in conserving vital oxygen and acetylene gases.

Exclusive construction incorporates grid-plate safety feature shown at right. MOTO METER Pressure Gauges are listed as approved by Underwriters Laboratories.

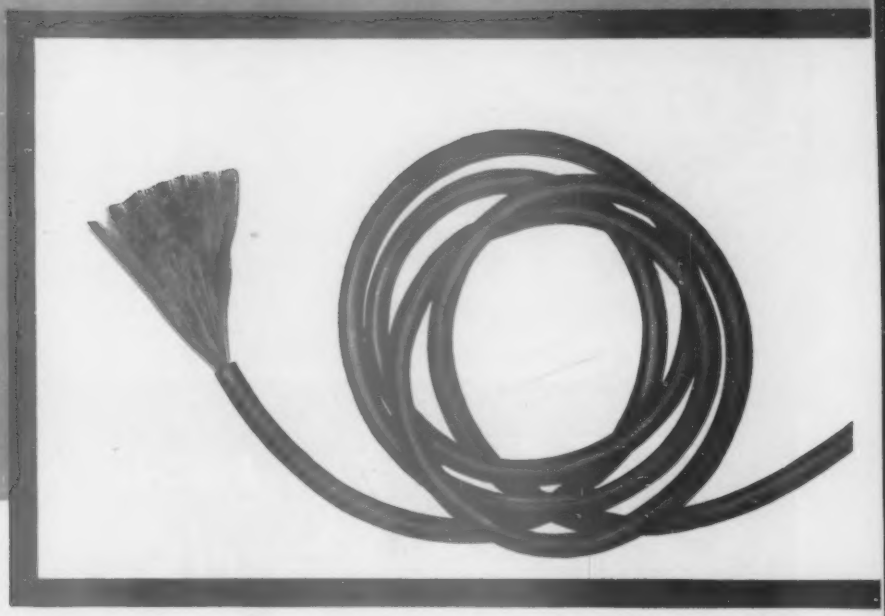


EXTRA PROTECTION

for operator and plant equipment is obtained through grid retainer plate, exclusive with MOTO METER Pressure Gauges.

THE ELECTRIC AUTO-LITE COMPANY
MOTO METER GAUGE & EQUIPMENT DIVISION
CHRYSLER BUILDING, NEW YORK, N. Y.
FACTORY LA CROSSE, WISCONSIN

A TIGER FOR TOUGHNESS



BURDOX

"Extra-Flex" WELDING CABLE

Contributes to Faster Production, Lasts Longer Under Hard Usage

TOUGH YET FLEXIBLE

LOW PRICED—yet performance equals that of many cables in higher price ranges.

TOUGH JACKET—with heavy, live rubber protects wires, withstands abusive treatment.

FLEXIBLE—extra "stretchability" makes cable coil readily and easily.

LARGE NUMBER OF WIRES—of bright copper of hair-width sizes, properly wound, and separated from outer rubber by protective wrapping of heavy tape.

LONG LIFE—is assured by use of finest materials and expert workmanship.

Write for the new Burdett catalog which gives complete specifications on Extra-Flex Welding Cables, as well as description of other outstanding Burdox Welding and Cutting Products.

Products and materials that hinder workmen and slow down deliveries are "out" for the duration. With welding cable, as with other materials of importance, time-saving features, lasting qualities, and performance advantages are vital essentials *now!*

Extra-Flex Welding Cable is made to serve under *today's* conditions. Because it has greater "wear-resistance" and holds its shape better under the destructive actions of oil and water, it promotes faster production.

Tough . . . yet flexible, it is engineered to meet the present demands of high-speed welding operations. Since "the smaller the wire, the greater its flexibility", the copper conductor of Extra-Flex Cable is composed of thousands of tiny wires which allow the cable to coil readily and easily. These wires are properly wound and separated from a tough jacket of heavy, live rubber by a wrapping of heavy tape. Extra-Flex Welding Cable in sizes from 6 to 4/0 is handled by distributors and welding supply houses throughout the United States.

63% TO 155% MORE RESISTANCE TO ABRASION!

Proved under actual test made by pulling four competitive makes of cable over a round surface covered with heavy emery cloth. Cable was pulled back and forth at the rate of twenty cycles per minute until insulation was worn through. Extra-Flex Cable outlasted the others by ratios of 63% to 155%!

HOLDS ITS SHAPE ⅙ TO ⅓ BETTER!

Cables were immersed in oil for periods of seven and fourteen days. They were then taken out and the increase in cable diameter due to swelling was measured. Extra-Flex Cable showed far less distortion than any of the other makes tested.

If you have a proper priority, and your local distributor cannot offer you prompt shipment, send us his name and address, and we will arrange to meet your needs to your satisfaction.

THE BURDETT OXYGEN COMPANY

3300 LAKESIDE AVENUE • CLEVELAND, OHIO

AWS Papers in Digest Form

(Continued from page 39)

Control of Welding in Shipbuilding

By R. W. BRENDLE
Tampa Shipbuilding Co.

THE PURPOSE of this paper was to stress the necessity for and the operations and responsibilities of a welding control center. The functions of such a control center were defined and described as follows:

Design and Redesign: Among a number of examples of designing for welding are the changing of the inner bottom of an auxiliary Naval vessel from riveted to welded construction with a saving of over 40,000 rivets per vessel, and the design of a stern frame fabricated by arc and thermit welding.

Ship Repair and Conversion: Numerous problems involving the rebuilding of damaged hulls and the repair of sabotaged or broken machinery are encountered daily. The welding control center should give timely advice on how welding can be utilized.

Testing and Training of Welding Operators: A welding control center should determine the exact type of training which will best suit the needs of the individual yard involved. A standard welding course covering welding in all its phases should be disregarded during the present emergency, and each yard attempt to train for its own individual wartime needs.

Welding Equipment and Supplies: A welding control center should set up specifications for necessary welding equipment and supervise the protection and maintenance of such equipment.

Welding Procedures: Written welding procedures should be prepared to give step-by-step information to the men building each subassembly, structure, etc.

Allied Processes: There are various allied processes which go hand in hand with cutting. A welding control center should determine which of these processes are necessary and see that they are correctly applied. Such processes are flame-hardening, flame-descaling, metal spraying, stud welding, X-Ray and magnetic inspection, resistance welding, etc.

Coördination: Probably the most important function of the welding control center is to coördinate with the various building divisions of a shipyard in introducing new equipment and new methods.

» «

Ordnance Flame-Hardening

By STEPHEN SMITH
Development Engineer,
Air Reduction Sales Co.

WHEN our country was suddenly plunged into war, peacetime heat-treating facilities, even though completely converted, could not meet the overwhelming demands for volume work. The answer to the deficiency was found in flame-hardening and induction hardening.

A new technique—simultaneous flame-hardening and tempering was immediately utilized for ordnance heat-treating, particularly on Army tank bogie wheel rims. It is applied, using the progressive method of flame-hardening, with a multiflame oxy-acetylene torch, followed by the customary water quench. This, in turn, is followed by a soft multiflame torch which heats the hardened wheel rim to the proper drawing temperature, thus producing the desired intermediate surface hardness. Machines for hardening large wheels handle four at a time and can harden one wheel in eight minutes.

Also being hardened by the flame process on a production basis are Army tank turret rings. These rings are hardened after finish machining, with negligible distortion and without need for subsequent machining or grinding.

All tank sprockets are now specified to be flame-hardened. The length of service of the hardened part is three to four times that of the untreated sprocket. Sprockets are hardened in various manufacturing plants by a variety of techniques, some manual, some semiautomatic and some largely automatic.

Among the other ordnance parts which are being flame-hardened in large quantities are tank tread grousers, tractor roller hubs and tractor links. The grousers are hardened on a production basis at one plant by the spot hardening method, electric timers being employed. The tractor parts are hardened at the rate of 25 rollers per hour, and the link parts at 100 pieces per hour.

— CHEK-SHOCK Oxygen CUSHION Valve —

- Will definitely prolong life of regulator assembly.
- Tank valve may be opened rapidly without any damage to regulator or danger to operator.
- Not necessary to release control screw before opening tank valve. (This will prevent unnecessary internal wear.)
- Automatically shuts off oxygen supply in case of a broken hose line.

This NEW automatic safety device CUSHIONS the initial BLAST of pressure when tank valve is turned on (*this uncontrolled surge which strikes like a hammer, is the direct cause of most all damaged regulators and accidents*). Thereafter pressure slowly equalizes and then CHEK-SHOCK allows a full flow of oxygen.

ONLY *ONE* MOVING PART, POSITIVELY FOOLPROOF

RECOMMENDED for ANY STANDARD SIZE Oxygen REGULATOR

* PRICE IS LESS THAN ONE REPAIR BILL *

Universal coupler type (will fit any oxygen regulator) ..... $6.00 each

Screw-in type (for removable entrance stem regulators only) ..... $5.00 each

Send orders with M.R.O. to—

SAFETY SHOCK MFG. CO.
FOWLER, CALIFORNIA

Now—Get Both

VARIABLE SPEED

and a

SELECTIVE SPEED LOCK

On this revolutionary new

BENTLEY

Welding Positioner

★ Now—one of the biggest advances in welding positioner ease and speed that have been made in the last 10 years. Here's why:

★ If you're doing a single-piece job, just use the variable speed foot accelerator and rotate the table at any speed you want for the job.

★ But if it's a multiple-piece job, start with the variable speed foot accelerator until you've found the exact speed best suited to the work. Then hold that speed by locking the selective speed lever. The table will continue to rotate at the speed you've selected.

★ If the piece requires two different speeds—as for a large outer and a smaller inner circumference, that's easy. Just shift the selective speed lever to a predetermined position. No trouble at all. This and other features reduce the demand on the operator's attention—help you get more than 5 men's output for every 4 men working.

Model shown has variable and selective speed rotation, plus air-operated hydraulic tilt through 90°. Also available in following models: Model AM-5—Manual rotation with air-actuated hydraulic tilt . . . Model MM-5—Manual rotation with manual tilt . . . Model MV-5—Variable speed rotation with manual tilt.

Write for full description and prices

BENTLEY WELDERY, Inc.

SYRACUSE, N. Y.

Aluminum Bronze Weldrod Licks Your Bearing Problem

AMPCO-TRODE
COATED ALUMINUM BRONZE WELDING ROD

Progress with welding and fabricate your bearing surface with longer-wearing, trouble-free aluminum bronze.

Use Ampco-Trode for manufacturing or maintenance. Deposit the same high-performance bearing overlay on your job that has found wide acceptance in U. S. arsenals, ordnance, and war production plants.

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THE METAL WITHOUT AN EQUAL

Inspection of Pressure Vessels and Piping

By W. D. HALSEY

Hartford Steam Boiler Inspection & Insurance Co.

VISUAL, radiographic, sampling, and magnetic powder methods of inspection of welding are all applicable, in at least some degree, to pressure vessels and piping. In fact, some of these methods are mandatory in the widely recognized construction codes such as the ASME and the API-ASME Pressure Vessel Codes. Except for the specific requirements of such Codes, any decision as to what method of inspection should be followed must be based on the nature of the information desired.

The visual method of inspection for weld soundness is applicable primarily only while the weld is being made. Unfortunately a weld that "looks all right" on the surface may be a very unsound one. However, visual examination of a weld as it is made affords an opportunity to determine that the parts have been properly prepared for welding, that acceptable materials are being used, that the welding operator is keeping the weld free from serious slag inclusions and that the weld is being fused to the base material.

Radiographic methods of inspection are most suitable on butt welds where both sides of the weld are readily accessible, are less applicable to welds attaching nozzles to shells.

The X-ray method is most generally applicable in the shops of manufacturers of pressure vessels although some X-ray examinations have been made in the field. However, such applications of the X-ray method in the field are limited because of the bulk of the equipment involved. On the other hand, the gamma-ray method involves equipment of relatively small bulk.

The sampling method of inspection of welding may be carried out either by the trepanning of plugs or by the removal of a boat-shaped specimen accomplished by the use of equipment known as a "weld prober." Either of these methods removes samples from the welded seams at selected points. These may be locations that are definitely under suspicion or they may be selected at random to get an idea of the average quality of the weld.

The boat-shaped specimen removed by the weld prober provides material that can be tested in several ways for soundness, for tensile strength and for ductility. The opening left in the weld is similar in many respects to a welding groove and thus lends itself readily to rewelding without great difficulty.

The magnetic powder method of inspection will show any crack that extends to the surface and may also reveal subsurface defects provided they are not too far below the surface and are of sufficient magnitude. Inasmuch as cracks which develop in welds as they are being made are one of the most serious types of defect that may be encountered and are frequently difficult to detect except upon a most minute examination, the magnetic powder method of inspection is valuable to insure that no cracks exist in a given layer of welding before the subsequent layer is deposited. In many instances, this method of inspection has been used for each layer of welding as applied.

Molten Metal Sprayed on Wood Patterns Prolongs Their Life

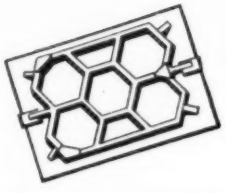
Molten metal sprayed on wood foundry patterns by a compressed air gun provides a protective coating against sand wear on the finished surfaces, thereby prolonging the life of the pattern and eliminating costly repairs.

The metal may be sprayed directly on the untreated wood surface of the pattern or core box. If the wood surfaces are hard or close-grained, a shellac primer is first applied, the metal being sprayed on before the shellac dries. The thickness of the metal coating is about 5 thousandths of an inch.

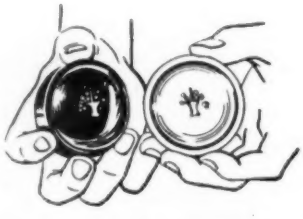
The spraying equipment consists of a portable, self-contained gun-type sprayer which melts the metal and is thermostatically controlled.

We hope this has proved interesting and useful to you, just as Wrigley's Spearmint Gum is proving useful to millions of people working everywhere for Victory.

You can get complete information about this method from Alloy-Sprayer Company, 2039 Book Building, Detroit, Michigan.



This wooden pattern coated with sprayed metal has given service far beyond its normal life.



Fine detail easily recorded in the alloy sprayed onto pattern.

X-56

Welding Operator Training

By A. N. KUGLER

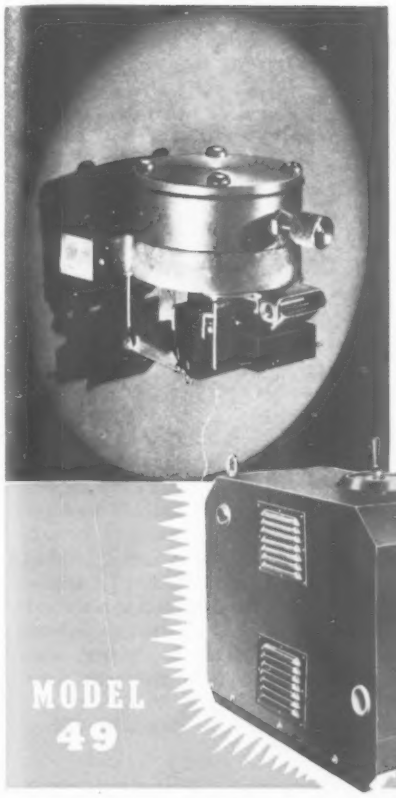
Applied Engineering Dept.,
Air Reduction Sales Co.

ONE OF the important problems affecting war production has been the need for training of inexperienced welding operators. It has been necessary to train ten to twelve times as many new operators as there were experienced weldors available in 1938. The greater part of this training was done in 1941 and 1942, throwing a large burden upon the established welding schools. So great was the scramble for training among prospective weldors, and for students among newly-organized schools, that standards of instruction suffered. In order to maintain standards at a reasonable level, there was formed the American Welding Society's Committee on Minimum Requirements of Instructions for Welding Operators in Trade Schools.

To demonstrate the coverage of AWS training codes and the requirements imposed, this paper presented in some detail the conduct of the course given at Pratt Institute, Brooklyn. This course follows closely the section of Code B-1, which covers training of Class A weldors, and every graduate who has taken either the Army or the Navy certification tests has passed them successfully.

G-R *announces* VOLT-O-MATIC CONTROL

(Automatic Open Circuit Voltage Variation)



● WHEN changing electrodes in hot or wet weather G-R provides *extra safety* for operators of **already safe* G-R Welders.

The instant actual welding stops, G-R *VOLT-O-MATIC* control drops open circuit voltage from 80 to below 25 . . . automatically raises it to welding level when contact with the work is re-established. Now standard on G-R Model 49 at no price increase, optional at extra cost on other G-R industrial models.

***SAFETY** has long been a G-R feature, due to the absence of surge voltages and capacitance effects when properly grounded.

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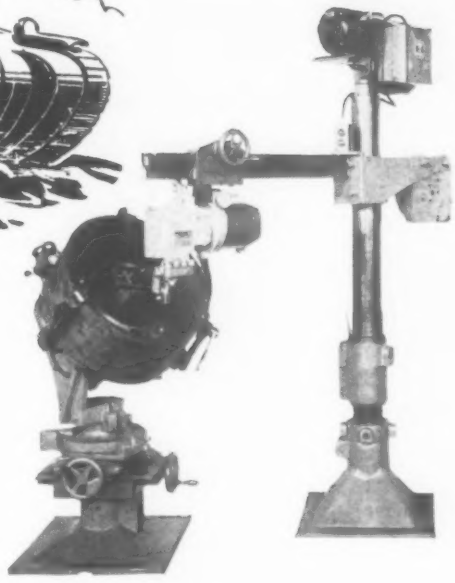
P. O. Box 1814, Washington, D. C.

Quicker Welding . . With This Automatic Welding Machine Fixture



THIS Acme dual fixture arrangement permits practically constant use of an automatic welding head, because one of the fixtures can be reloaded while the other is engaged in the welding operation.

The holding machine can be set to revolve at any angle from vertical to horizontal. (Illustration shows a wheel being welded at 45° angle.) Positioner arm swings from one fixture to the other, locking in proper position. Speed of rotating the work is adjustable, as desired.

Reloading Is done During Welding Operation

ACME *Manufacturing Co.*
1642 HOWARD ST. • DETROIT, MICH.

WRITE
for information. Whatever your positioning problem on automatic welding, let us help you solve it. Write for complete information.

Reclamation of Perishable Tools

By W. A. JOHNSON

International Harvester Co., Tractor Works

THIS PAPER described the application of the "low-temperature brazing" process to the reclamation of cutting tools. Cracked slitting saws, broken milling cutters, broken flat, round, and multiple spline and keyway broaches, extension reamers, drills and broken dovetails on forming tools and many other examples have been reclaimed by this method.

Steps common to this type of tool reclaiming are: (1) prepare the surfaces to be joined; (2) clean surfaces thoroughly with carbon tetrachloride using a soft bristle brush; (3) coat with autochemic flux the surfaces to be brazed; (4) apply an oxy-acetylene torch to the joint ends; (5) apply the brazing material until it flows freely through the joint; (6) grind or file for removal of excess material; (7) sharpen the tool.

In most cases, it is also necessary to thoroughly preheat a tool before attempting to braze. This preheating can either be done by the torch before starting actual brazing or a small furnace with heat regulation may be used. The preheating temperature should be between 600 and 800 F. After brazing, it is advisable to place the tool back in the furnace and allow it to cool off gradually or place it in mica or asbestos.

Several rods may be used for low-temperature brazing. These are all chiefly alloys of copper, zinc, nickel, phosphorous, cadmium and a medium amount of silver, 40% to 60%. Their melting points vary from 800 to 1,600 F; the alloys used in tool brazing range in melting points from 1,175 to 1,300 F. Since these temperatures are very near the drawing temperature of high speed tools, the weldor must learn the correct manipulation of his torch and heat so as not to harm the tool.

A BETTER POSITIONER FOR EVERY WELDING JOB

No matter what type welding you do there's a C-F Positioner exactly suited to your requirements. Ranging from small hand operated models like the one above to the giant, push button controlled, monster shown below, C-F Positioners revolve weldments a full 360 degrees, tilt them to 135 degrees beyond horizontal—permit down-hand welding of all sides with a single set-up. All are universal tools; *are adjustable for height,* handle a wide range of work and are pedestal or boom mounted to give maximum floor and working clearance.

Write for Bulletin WP 22.

Above: Model No. 12. 1,200 lb. capacity, manually operated.

Below: Model No. 300. 30,000 lb. capacity, push button control with variable speed rotation for automatic welding.

CULLEN-FRIESTEDT CO. 1309 S. Kilbourn Ave., Chicago 23, U.S.A.

Aircraft Spot Welding

By NATHAN C. CLARK,

Senior Research Engineer,
Lockheed Aircraft Corp.

THIS PAPER was a review of the steps that may be taken to insure the highest quality of spot weld production in the aircraft industry. It was shown that of the various procedures considered the practical solution to the problem of quality control of spot welding production involved three basic requirements: (1) standardization of the equipment and process; (2) the application of statistical control and (3) monitoring of the spot welding machines or nondestructive testing of the finished product. The features of spot welding machines mostly in need of standardization were said to be the controls of: (1) energy delivered to the weld, (2) electrode current wave shape, (3) the amount of electrode force, (4) forge time delay, if used, and (5) the shape, surface condition and life of the electrode tips.

Spot Weld Joint Efficiency for Aluminum Alloys

By C. W. STEWARD

Curtiss-Wright Corp.,
Research Laboratory

ONE OF the design problems about which little has been published is that of the maximum efficiency of a multi-spot joint used for splicing sheets of aluminum alloy together. This paper was presented for the purpose of reporting the major results of a fairly thorough study. The following conclusions were reached:

1. Maximum joint efficiency obtained was 100%, as indicated by several samples which failed outside the weld pattern. However, the average was 93%.
2. Maximum stress developed on a standard specimen was 61,800 psi. The average was 59,800 psi.
3. The ideal spot pattern for 24S-T Alclad in 0.040 in. thickness is one in which the spots are spaced ½ in. apart in both directions. Reduction in this spot spacing is likely to result in a loss in strength.
4. Maximum efficiency is attained with A-C welds.
5. High strength spots are better than low strength spots for maximum efficiency and production economy.
6. Wire brushing is better than chemical cleaning.
7. The presence of small cracks, visible by X-ray only, is not critical.
8. Higher strength welds (free from small internal cracks) can be made with A-C equipment than can be made with D-C equipment.
9. With stored energy machines, current wave shape makes very little difference to joint efficiency.

Hardness Conversion Table

BRINELL		Vickers or Firth Hardness No.	ROCKWELL		Scleroscope No.	Tensile Strength 1000 psi.
Dia. in mm., 3000 kg. load 10 mm. ball	Hardness No.		C 150 kg. load 120° Diamond Cone	B 100 kg. load 1/16 in. dia. ball		
2.05	898					440
2.10	857					420
2.15	817					401
2.20	780	1150	70		106	384
2.25	745	1050	68		100	368
2.30	712	960	66		95	352
2.35	682	885	64		91	337
2.40	653	820	62		87	324
2.45	627	765	60		84	311
2.50	601	717	58		81	298
2.55	578	675	57		78	287
2.60	555	633	55	120	75	276
2.65	534	598	53	119	72	266
2.70	514	567	52	119	70	256
2.75	495	540	50	117	67	247
2.80	477	515	49	117	65	238
2.85	461	494	47	116	63	229
2.90	444	472	46	115	61	220
2.95	429	454	45	115	59	212
3.00	415	437	44	114	57	204
3.05	401	420	42	113	55	196
3.10	388	404	41	112	54	189
3.15	375	389	40	112	52	182
3.20	363	375	38	110	51	176
3.25	352	363	37	110	49	170
3.30	341	350	36	109	48	165
3.35	331	339	35	109	46	160
3.40	321	327	34	108	45	155
3.45	311	316	33	108	44	150
3.50	302	305	32	107	43	146
3.55	293	296	31	106	42	142
3.60	285	287	30	105	40	138
3.65	277	279	29	104	39	134
3.70	269	270	28	104	38	131
3.75	262	263	26	103	37	128
3.80	255	256	25	102	37	125
3.85	248	248	24	102	36	122
3.90	241	241	23	100	35	119
3.95	235	235	22	99	34	116
4.00	229	229	21	98	33	113
4.05	223	223	20	97	32	110
4.10	217	217	18	96	31	107
4.15	212	212	17	96	31	104
4.20	207	207	16	95	30	101
4.25	202	202	15	94	30	99
4.30	197	197	13	93	29	97
4.35	192	192	12	92	28	95
4.40	187	187	10	91	28	93
4.45	183	183	9	90	27	91
4.50	179	179	8	89	27	89
4.55	174	174	7	88	26	87
4.60	170	170	6	87	26	85
4.65	166	166	4	86	25	83
4.70	163	163	3	85	25	82
4.75	159	159	2	84	24	80
4.80	156	156	1	83	24	78
4.85	153	153		82	23	76
4.90	149	149		81	23	75
4.95	146	146		80	22	74
5.00	143	143		79	22	72
5.05	140	140		78	21	71
5.10	137	137		77	21	70
5.15	134	134		76	21	68
5.20	131	131		74	20	66
5.25	128	128		73	20	65
5.30	126	126		72		64
5.35	124	124		71		63
5.40	121	121		70		62
5.45	118	118		69		61
5.50	116	116		68		60
5.55	114	114		67		59
5.60	112	112		66		58
5.65	109	109		65		56
5.70	107	107		64		56
5.75	105	105		62		54
5.80	103	103		61		53
5.85	101	101		60		52
5.90	99	99		59		51
5.95	97	97		57		50
6.00	95	95		56		49

Make Good Piping Better

with

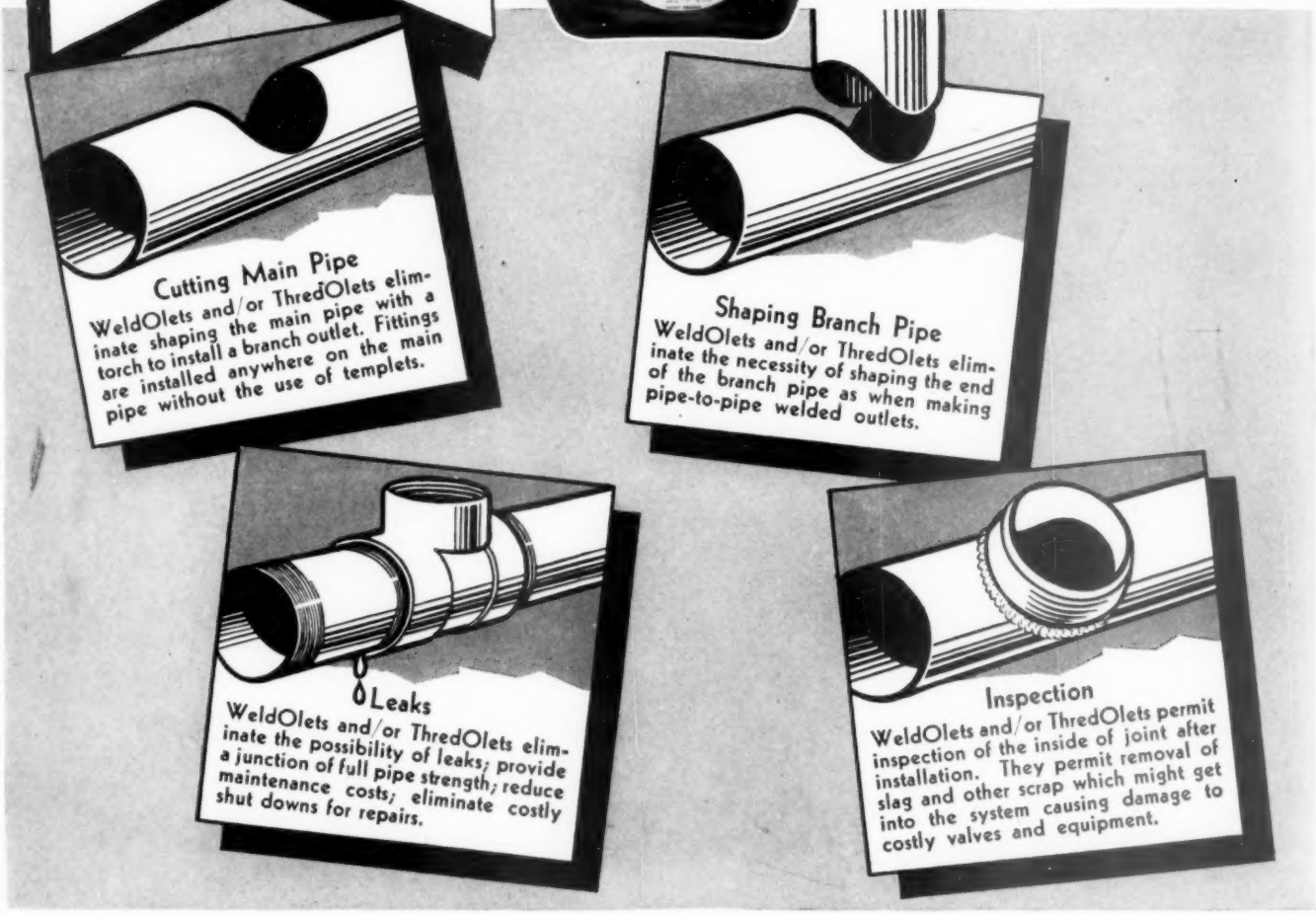
WELDOLETS THREDOLETS

3 Types Meet Every Need

WeldOlets for butt welded branch connections.

ThredOlets for screwed branch connections.

Socket-End WeldOlets for socket-type welded branch connections.



Cutting Main Pipe

WeldOlets and/or ThredOlets eliminate shaping the main pipe with a torch to install a branch outlet. Fittings are installed anywhere on the main pipe without the use of templets.

Shaping Branch Pipe

WeldOlets and/or ThredOlets eliminate the necessity of shaping the end of the branch pipe as when making pipe-to-pipe welded outlets.

Leaks

WeldOlets and/or ThredOlets eliminate the possibility of leaks; provide a junction of full pipe strength; reduce maintenance costs; eliminate costly shut downs for repairs.

Inspection

WeldOlets and/or ThredOlets permit inspection of the inside of joint after installation. They permit removal of slag and other scrap which might get into the system causing damage to costly valves and equipment.

WeldOlets, ThredOlets and Socket-End WeldOlets are suitable for all commonly used pressures and temperatures in every type of piping system. They are installed either before or after erection of the main line—and always with ease and economy. They are equally well adapted to prefabricated or "on-the-job" assemblies. Because of their patented, funnel-shaped intake aperture they improve flow conditions. Carried in stock for all standard pipe sizes up to 12" in size-to-size or reducing sizes—and can be furnished on special order in sizes up to 24". Stock fittings are drop forged steel, but to meet special conditions will be supplied in Monel, Everdur, Toncan Iron, wrought iron, etc.

Bulletin WT31 gives detailed information about all the advantages of WeldOlets, ThredOlets and Socket-End WeldOlets. Write for a copy today.

Forged Fittings Division

BONNEY FORGE & TOOL WORKS, ALLENTOWN, PA.

Star Awarded July 10, 1943

WELDOLETS · THREDOLETS

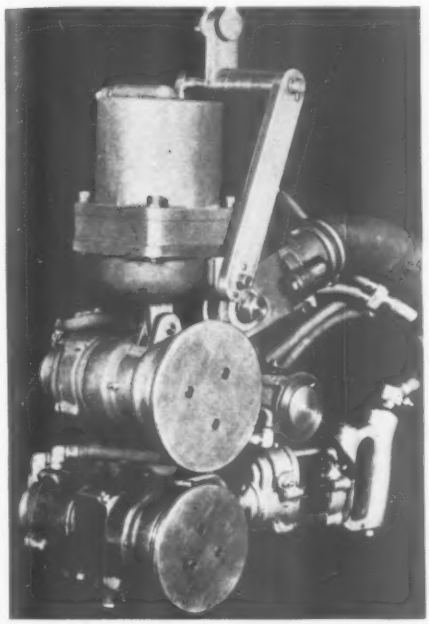
TRADE MARKS · REG. U S PAT. OFF.

Welded Outlets for Every Piping System

New Products to Use

Seam-Welding Gun

★ Parts that are too big to "take to the machine" as well as large assemblies mounted in stationary fixtures can now be seam welded by means of a new portable air-operated seam-welding gun. This machine, believed to be the first practicable portable seam welder made available to industry, is designed for



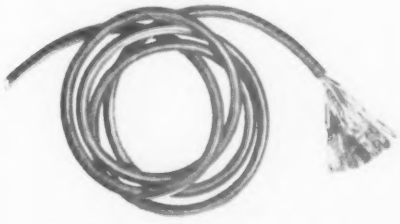
Portable seam-welding gun just announced by Progressive Welder Co. It may be used for welding either plain carbon or stainless steel sheets up to 20 gauge thickness.

welding two steel sheets up to thicknesses of 20 gauge each, including stainless steels. The gun is universally suspended and can be swiveled about so that the operator can weld either horizontally or vertically. Its standard speed is between 48 and 52 in. per min, using standard rolls or wheels.

The head is operated by an air motor, rated at 2 hp when run at a constant speed, using 42 cfm of air under load. When the control button (located on the guide handle) is pushed, it operates a solenoid switch that lets air into the cylinder. The air cylinder has a diam of 4½ in., which is large enough to provide a maximum pressure of 1,400 psi with line pressure of 90 psi. The air flowing into the cylinder forces the upper (idling) and lower (driven) wheels together. When the air pressure has reached the preset value, a pressure switch starts the welding timer and the gun begins to seamweld. When pressure is removed from the button control, the solenoid valve releases the air in the cylinder, and, at the same time, the pressure switch cuts off both the timer and the welding current.

This gun requires a high-duty cycle and high current densities, necessitating provision for about 5 gallons of cooling water per minute to give optimum performance. Transformer, cable, jumper and bushings are all water cooled. The wheels are cooled internally, but spray cooling for their external parts is available if needed.

The gun has a throat depth of 3 in. Its stroke is ½ in. when the wheels are new, 2 in. maximum when the wheels are worn. Two wheels—one 5 in. and one 6 in.—are provided. The transformer is rated at 100 kva and operates at 440 v, 60 cycles A-C. The recommended maximum duty is 2 cycles "on" (welding) and 4 cycles "off" (cooling). **Progressive Welder Co.**, 3050 E. Outer Drive, Detroit 12.



"Extra-Flex" welding cable. The frayed end shows the method of construction.

Welding Cable

★ **Burdox "Extra-Flex"** welding cable is available in all sizes from 6 to 4/0. The cable is made of fine copper wires which are separated from a tough jacket of heavy rubber by a wrapping of heavy tape. It is said to have good resistance to abrasion and distortion and to be proof against oil and water. **Burdette Oxygen Co.**, 3300 Lakeside Ave., Cleveland.

» «

Breast Protectors

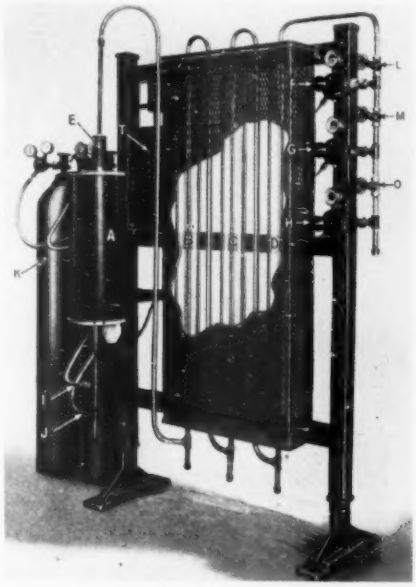
★ For women doing men's work, the **Willson "Saf-t-Bra"** is a unit comprising a pair of lightweight breast protectors and an adjustable suspender harness. The protectors are molded of a flesh-colored plastic material which provides resistance to impact, and they are shaped anatomically to fit the curvature of the body in the area they cover. The plastic forms extend well back under the arms, protecting not only the breasts but also preventing possible injury of the delicate lymphatic glands. **Willson Products, Inc.**, Reading, Pa.

Willson "Saf-t-Bra." For women employed where there is danger of breast bruises or injuries.

» «

Hydrogen Purifier

★ The removal of residual oxygen, moisture and other active contaminating gases from commercial hydrogen is said to be readily accomplished with new electric hydrogen gas purifying equipment being manufactured by the **Eisler Engineering Co., Inc.**, 740-770 So. 13th St., Newark 3, N. J. Under a pressure of 30 to 50 psi, the gas passes first through an electrically heated furnace—designated by "A" in the accompanying illustration. It then moves progressively through the glass containers "B," "C" and "D"—each 4 ft long and 3 in. in diam—filled with purifying ingredients such as caustic potash or sodium lime. From the last glass tube, the purified hydrogen enters a manifold with three outlets ("L," "M" and "O") leading to three different supply lines. Two steel cylinders ("K") containing the hydrogen under high pressure are independently connected through two flexible metal hoses, "I" and "J," and a brass pipe line to the electric furnace.



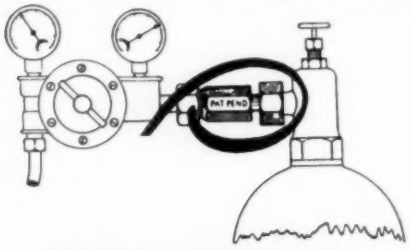
Eisler hydrogen gas purifier. This equipment is manufactured in different sizes, depending on the amount of gas required.

An autotransformer is provided for regulating the oven heat, which should never be over 1,200 F and preferrably at 980 F when best results are attained.

Oxygen Check Valve

★ This new automatic safety device was designed to cushion against the initial blast of uncontrolled pressure surging against the pressure regulator when the oxygen cylinder valve is turned. Thereafter the pressure slowly equalizes, and the **"Chek-Shock,"** inserted between the cylinder valve and the regulator, allows a full flow of oxygen to the regulator.

This oxygen cushion valve, states manufacturer, permits the cylinder valve to be opened rapidly without danger. **Safety Shock Mfg. Co.**, Fowler, Calif.

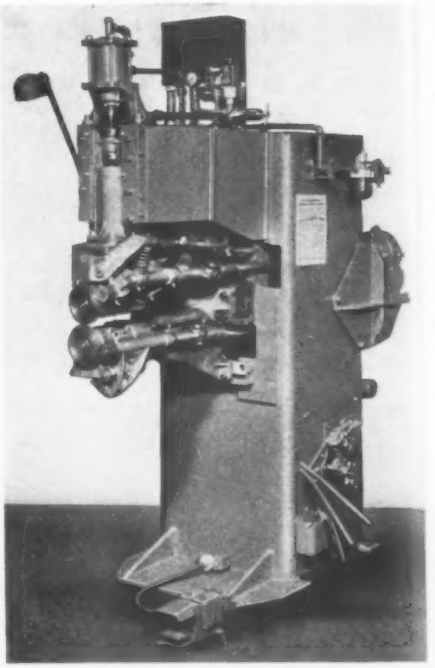


"Chek-Shock" oxygen cushion valve. Note its position between the cylinder valve and the regulator.

» «

Seam Welder

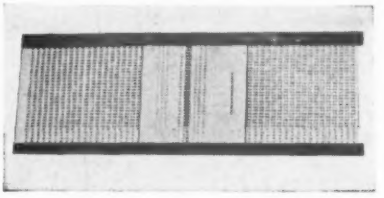
★ **Thomson Model 600** is a seam welder designed especially for the precision assembly of small or light pieces. It is available as a circular or longitudinal seam welder, or as a universal machine capable of rapid conversion for either type of welding, and is said to retain the adaptability and operating advantages of the Thomson Model 25.



Thomson seam welder. This unit was specifically developed for the production of light parts.

The upper welding head slides in flat gibbed ways that are readily adjustable to allow for wear. Knurl drives on both upper and lower welding wheels are said to assure positive drive and constant speed. A variable speed drive and worm reduction unit provides a wide range of welding speeds. Welding pressure is supplied by a double-acting air cylinder, which is adjusted by a regulating valve. **Thomson-Gibb Electric Welding Co.**, Lynn, Mass.

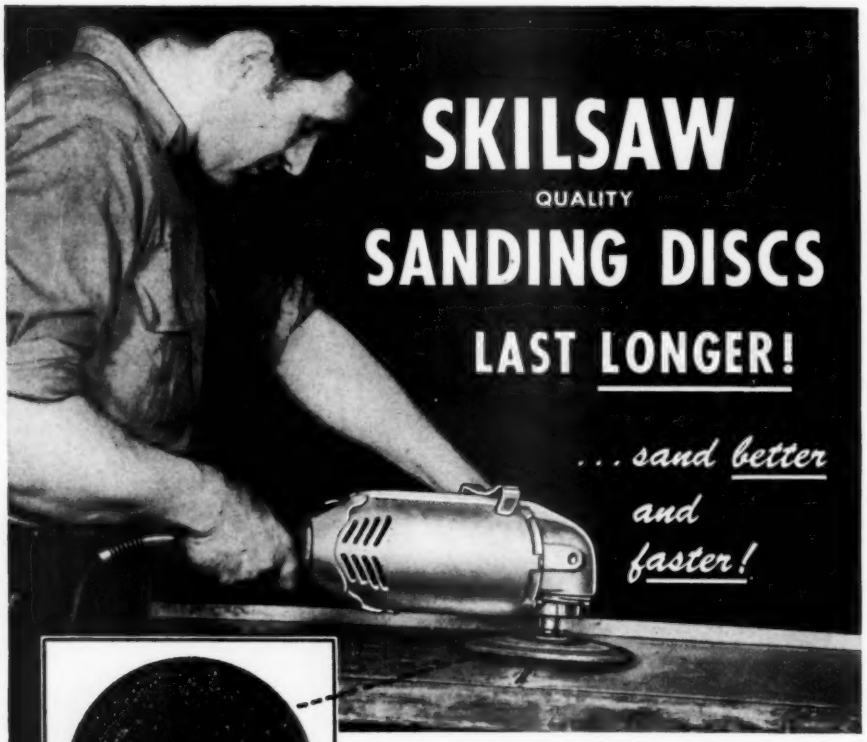
» «



A slide rule for payrolls. Both overtime and straight time can be figured in a jiffy with this ingenious new device.

Payroll Calculator

★ "Forty hours plus overtime" are calculated in one operation on one side of a new payroll calculator now being made by the **Berger-Brickner Co.**, 433 So. Spring St., Los Angeles 13. The reverse side of the calculator is used for figuring straight time and overtime as separate items. Hourly rates of pay from 40c to $1.74, with a half cent spread between rates, are provided. The time periods extend up to 80 hours and are divided into tenths and quarters of an hour.



Whatever your metal-finishing jobs may be . . . you'll finish faster and better with SKILSAW Quality Sanding Discs. They're scientifically made of finest materials to sand *smoother* and to wear *longer!*

SKILSAW Quality Sanding Discs are made of sharp-cutting aluminum oxide bonded with heat-resisting resin to a flexible fibre back. Available in 2 sizes and in all popular grits and grades to insure peak output on every job. Write for recommended types on your sanding operations . . . or phone your distributor for SKILSAW Quality Sanding Discs *today!*

ARMY E NAVY

SKILSAW, INC., 4763 Winnemac Ave., Chicago 30, Ill.

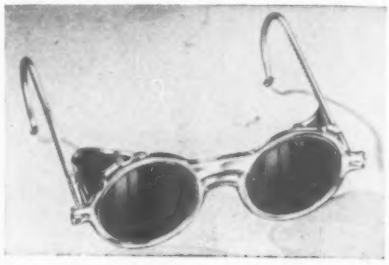
SALES AND SERVICE BRANCHES IN ALL PRINCIPAL CITIES

SKILSAW PORTABLE ELECTRIC TOOLS

★ *MAKE AMERICA'S HANDS MORE PRODUCTIVE* ★

Safety Goggles

★ These new **Welsh goggles** have a lightweight acetate plastic frame, and lenses locked into a bezel—a patented



Welsh lightweight plastic goggles. Either shaded lenses for welders or clear, hardened lenses for grinders and chippers may be obtained.

construction said to provide unusual strength. They may be worn over a worker's prescription glasses and are available with or without side shields. The shields, which are hinged to fold back when goggles are not in use, are furnished in either transparent acetate plastic or in metal mesh.

For flash and glare protection, the goggle frames are fitted with Federal specification "Welshade" absorptive lenses. For chippers' use, "Welshard" clear, hardened lenses are provided. **Welsh Mfg. Co.**, Providence, R. I.

» «

Heat-Resistant Mitt

★ This one-fingered mitt of heat-resistant leather has been developed to substi-

Wool-lined leather mitt designed to substitute for asbestos mitts.

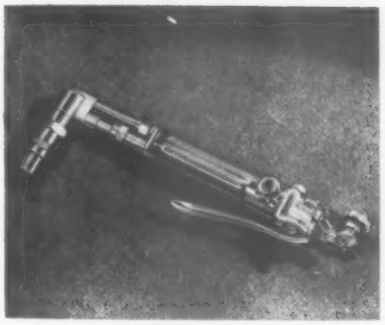
tute for the ordinary asbestos gloves and mittens, of which there now exists a serious shortage. The new leather mitt is lined with wool and made with a 4 in. gauntlet. Extra protection is provided for the wrist and the thumb is reinforced with a leather strap. **Industrial Gloves Co.**, Danville, Ill.

» «

Underwater Cutting Torch

★ This improved underwater cutting torch design, **Victor Model 3900**, is said to offer the following added conveniences:

(1) The air mantle is so designed that it limits slagging of the tip, and permits



Victor Model 3900 torch for underwater cutting. It is said to permit operation at heretofore unaccustomed speed.

adjustments to be readily made underwater with less risk of losing parts.

(2) The gas control valves are so located and designed that they can be manipulated even when the diver is wearing heavy gloves and operating in murky water.

(3) The torch will start the cut and do the cutting with greater speed.

(4) The torch is more easily maintained in service; occasional reconditioning can be undertaken with a minimum of previous skill or special tools.

Divers or engineers may secure a descriptive bulletin by addressing the **Victor Equipment Co.**, 844-54 Folsom St., San Francisco 7

Castolin Eutectic

EUTECTIC*

(Means Lowest Melting Alloy)

LOW TEMPERATURE WELDING

FREE LATEST

WELDING DATA BOOK

Contains the Answers to Hundreds of Wartime Welding Problems

Contains vital facts to speed up your production and cut your welding costs with Eutectic Low Temperature Welding. Also valuable information on:

Production Welding

Joining dissimilar metals and dissimilar gauges without burning • Design simplification • Substitution of butt joints for lap joints, etc.

Salvaging Defective Castings

Effectively at low cost • Completely machinable, invisible welds • Ideal for thin walled or heavy castings in all metals.

Maintenance Welding and Tool Salvaging

"Hard-to-get" tools costing up to $180 and requiring up to 50 weeks for delivery, salvaged for re-use in a few minutes at a cost of but a few cents.

Ordnance Plant Engineer writes: "Book very instructive, send ten more for distribution."

Write for Welding Data Book K

See our Exhibit at the 19th Exposition of Chemical Industries **BOOTH No. 403**

Madison Square Garden, N. Y. Dec. 6-11

*Reg. U. S. Pat. Off.

EUTECTIC WELDING ALLOYS COMPANY

Originators of the Low Temperature Welding Process

40 WORTH STREET, NEW YORK 13 N.Y.

EUTECTIC WELDING ALLOYS COMPANY
40 Worth St., N. Y. 13, N. Y.

Please send your latest Welding Data Book K

Name_____

Company_____

Address_____ City_____

Small-Size Hose Clamps

★ Two new clamps, models M-6 and M-10, for hose sizes from ¼ to ¾ in. ID, have been added to the **Aero-Seal** line of hose clamps. The M-6 is designed for ¼, ⅜ and ½ in. hose and the M-10 for ⅝ and ¾ in. hose.

In construction, these clamps are featured by a spring steel band that has been perforated to correspond with the teeth of a worm gear attached to a thumbscrew. Turning the screw draws the perforated band through the housing, thus producing a rapid clamping action. **Aircraft Standard Parts Co.**, 1711 Nineteenth Ave., Rockford, Ill.

Aero-Seal hose clamp. Turning the thumbscrew produces a uniform pressure around the entire periphery of the hose.

Face Shield

★ The **M.S.A. Type "H"** face shield has been developed for quick attachment to the Type "K" Skullgard protective hat

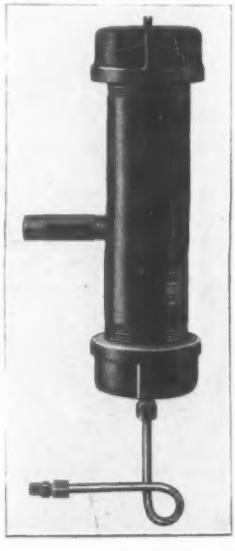
Face shield. The lower ends of the metal clips are slipped over the edge of the brim on each side of a "Skullgard" safety hat. The visor may be moved up or down to the desired position.

in order to guard the face against flying particles. The visor, which is made of transparent plastic, is fixed to a retaining strap mounted on a pivotal joint, allowing upward or downward movement of the shield to the position desired by the operator. Visors measure 14 in. wide by 6 in. long and are offered in 0.020, 0.040 or 0.060 in. thicknesses. Light or dark green visors are also furnished but only in the 0.20 in. thickness. **Mine Safety Appliances Co.**, Braddock, Thomas and Meade Sts., Pittsburgh.

» «

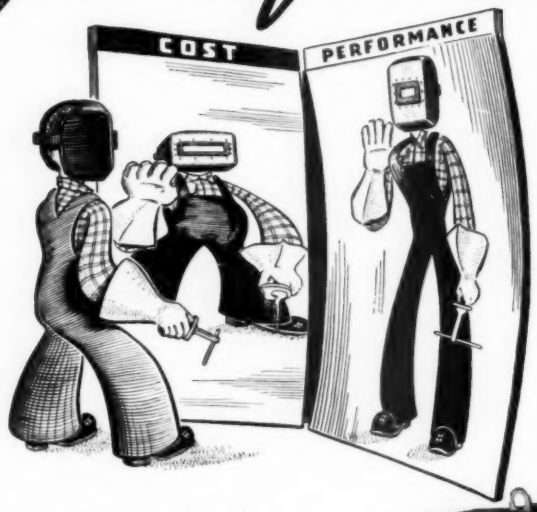
Industrial Humidifier

★ The **"Little Giant"** industrial humidifier is capable of dispensing 42 lb of water per hr or 120 gallons in 24 hr to improve atmospheric conditions in war plants. It measures 10 in. long, 3 in. in diam and can be installed in less than an hour's time. Adjustment screw at the top permits adjustment to obtain whatever relative humidity is desired. **Techtmann Industries, Inc.**, 828 North Broadway, Milwaukee 2.



"Little Giant" humidifier. It can be installed in single units or in clusters to allow for the humidification of any designated volume.

SHORT on COST
Long on Performance



What have magic mirrors to do with war production? Nothing, except they portray the idea of the results you'll get from the near magic of MARQUETTE'S fast, flawless, economical welding in all kinds of wartime metal fabrication or repair.

Their low original and operating costs, with negligible upkeep requirements, make for exceptional welding economy. Their instantaneous heat selection, automatic voltage control, no "magnetic blow" give these versatile A.C. machines outstanding speed and uniform, top-quality welding performance.

TEN SUPERB MODELS . . . with good delivery. 125 to 400 amps., for light work to continuous heavy duty production.

Send for free, 24 page, illustrated booklet.

MARQUETTE MFG. CO., INC.
MINNEAPOLIS, MINN.

MARQUETTE
REG U.S PAT OFF
A.C. ARC WELDERS

(Trade Mark Registered)

Specify Titan Welding Alloys

TO ASSURE UNIFORMLY SOUND, STRONG, DUCTILE BRONZE WELDS

Doubly-Deoxidized PENN BRONZE, TITAN BRONZE and TITAN MANGANESE BRONZE Welding Rods have proved their definitely superior welding qualities over a period of many years and under the most exacting requirements.

The Double-Deoxidization process, developed by Titan engineers, definitely increases the ductility of the weld metal, reduces fuming to a minimum and assures a sound, dense, strong weld.

Doubly-Deoxidized Welding Alloys:

PENN BRONZE

TITAN BRONZE

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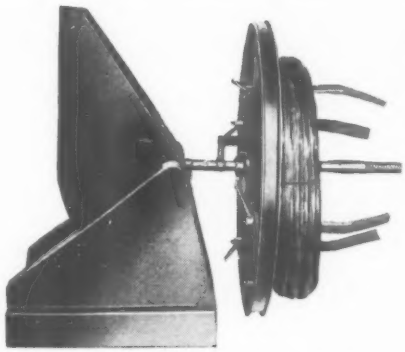
Descriptive literature sent upon request

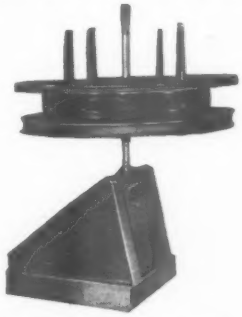
TITAN METAL MANUFACTURING CO., BELLEFONTE, PA.

TITAN WELDING RODS



Above —"Shiftweight" Loading Position

Below —"Shiftweight" Feeding Position



A Husky Helper . . . Always "On Its Feet"

• The Moslo "Shiftweight" wire reel eliminates the need for an extra man in handling coils of wire. It is counterbalanced with an automatically shifting weight that holds it steady in either loading or feeding position. Easy to load without lifting . . . Swings easily to feeding position . . . Feeds smoothly and kink-free. A back saver, time saver and money saver.

Write for booklet describing this and other types of wire reels. Upright or horizontal drum reels . . . Upright cone reels, all built to give service, speed production.

Moslo Makes Everything for the Welding Electrode Processing Plant

MOSLO MACHINERY COMPANY

2441 PROSPECT AVENUE • CLEVELAND, OHIO

News of the Industry

Amend Order Governing Maintenance and Repair

Preference Rating Order P-89, governing maintenance, repair and operating supplies, was amended on Sept. 29 by the War Production Board to conform with Priorities Regulation 3, which covers the uniform method of application and extension of preference ratings.

The amended Order P-89 restates the definition of maintenance, repair and operating supplies as including "minor capital additions, the cost of which does not exceed $500, excluding the producer's cost of labor, for any one complete addition which has not been subdivided for the purpose of coming within this definition."

The revised order will limit the use of P-89 ratings, instead of specifying various prohibited articles in P-89. A flat AA-1 rating and allotment symbol MRO P-89 are provided after January 1, 1944, with the restraining provision that the aggregate dollar value of purchase orders for materials for maintenance, repair and operating supplies placed by the producer during the calendar year 1944 may not exceed the dollar value of purchase orders for such materials placed by the producer during the calendar year 1943.

The small order exemption for purchases of aluminum in any quarter has been raised from 100 to 500 lb.

» «

Bans Foreign Silver for Brazing Alloys

Use of foreign silver in the manufacture of brazing alloys or solders has been prohibited by the War Production Board in its Amendment 1 to Conservation Order M-199. Manufacturers, however, may complete the processing of any foreign silver already in process, or use up to one month's supply of the foreign silver on hand as of July 29.

Order M-199 restricted the sale, delivery, purchase and receipt of silver to certain specific uses.

» «

Expands Facilities for Repair of Torches

Eastern Welding Equipment Co., 17 West 60th St., New York City, has expanded by more than 50% its facilities for the repair of all makes of oxy-acetylene torches, tips and pressure regulators. The service department is under the supervision of Frank Marcus, who has been actively engaged in the oxy-acetylene industry for the past 15 years. Twenty-four-hour service is said to be available when necessary to defense plants.

FASHION PLATE OF 1943. This girl welder at the East Pittsburgh Works of Westinghouse Electric and Mfg. Co., who is shown selecting an electrode to weld the frame of a big electric motor, is dressed in the very latest outfit for lady welders—safety glasses, flame-resistant canvas kepi, leather gloves, sleeves, apron, spats that repel hot metal and steel-toed safety shoes.

ASA Revises "Bible" of Grinding Industry

The American Standards Association's Abrasive Wheel Safety Code, so widely used that it has been called the Bible of the grinding industry, has been revised for the first time since 1935.

New sections have been added to keep pace with changes in this industry. Completely new rules have been written for mounted wheels. New speed rules have been drawn up for crankshaft grinding, camshaft grinding and thread grinding operations. While the Basic speed tables remain the same, the Code has been carefully reviewed and many points have been clarified.

The *Safety Code for the Use, Care and Protection of Abrasive Wheels* (B7-1943) may be obtained from the American Standards Association, 29 West 39th St., New York City 18.

» «

Tube Turns Opens West Coast Offices

Tube Turns, Inc., Louisville, Ky., has opened two new Pacific coast offices at San Francisco and Seattle, while closing its Los Angeles office. T. H. Pike, Jr., district manager for the Pacific coast area, is in charge of the San Francisco office at 2611-12 Russ Bldg. John M. Hartley, formerly of the Los Angeles office, is in charge of the Seattle office at Room 422-A, Smith Tower Bldg., Seattle 4.

New Electronics Wrinkles Discussed at G-E Gathering

Industrial electronics equipments have been directly responsible for saving millions of man and machine hours and millions of pounds of critical materials since Pearl Harbor, according to General Electric officials. Speaking at a Conference on Industrial Electronics held Sept. 14 at Schenectady, these executives pointed out that welding, heat treating, positioning, current and voltage control, temperature control, motor control, inspection and counting, power rectification and frequency changing, industrial X-rays and the electronic (induction) heating of metals are some of the fields falling within the scope of electronics.

E. H. Alexander, engineer of the industrial control division, detailed the important contributions of resistance welding control to war production. "No single industrial electronic equipment has contributed more to war production," he said.

An important recent contribution to resistance welding control, discussed by Mr. Alexander, is the electronic current-regulating compensator. This device compensates for variations in line voltage and for the amount of magnetic material in the throat of the welding machine, thus making it possible to obtain consistent welds when welding parts which are of irregular and varying shapes.

J. P. Jordan, electronics section, industrial heating engineering division, discussed electronic heating by means of high-frequency vacuum tube oscillators. This, he explained, is divided into two broad fields: the induction heating of metals and the dielectric heating of non-metallic materials. In induction heating, the part is placed in or adjacent to a water-cooled inductor coil carrying a high-frequency alternating current. The heat is generated entirely in a surface layer, the depth of which is determined by the frequency used.

Since this type of heat permits concentration on the surface of sharply defined areas, it is useful in the surface hardening of gears, bearings and other parts subject to surface wear, Mr. Jordan declared. In the brazing field, the main advantages are uniformity of results and automatic operation. Electronic heaters, the speaker emphasized, always produce the same temperature in the same area.

» «

War Production Awards Popular with Workers

Thousands of suggestions for increasing production from workers who want to do a better job have been recorded at War Production Drive Headquarters. Labor-Management Committees have been established in 2,400 plants in which 5,000,000 war workers are now employed.

Ideas which have been put into operation as a result of this program are said to have saved millions of dollars and hundreds of thousands of man-hours in America's mines, mills, factories and shipyards. A pamphlet briefly describing the award winning suggestions is available on request to War Production Drive Headquarters, Washington, D. C.

DALLETT

PNEUMATIC WELD-FLUX SCALING HAMMERS

Especially designed for roughing, peening, removing flux and excess metal resulting from welding operations.

- made in several sizes
- button or lever type throttle
- safety chisel retainer
- smooth in operation
- light in weight

write for Bulletin No. 500

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PNEUMATIC AND HAND CHISELS ■ *"DALBO" AIR HOSE COUPLINGS*

"DALLETT" PNEUMATIC SAFETY RETAINER SHANK CHISELS

■ ■ *"DALWELD" DETACHABLE WELDING CABLE CONNECTORS* ■ ■

THIS MOTOR BRACKET

typifies the advantages of modern EASY-FLO Brazed Construction

This hanger bracket for a small electric motor used in airplanes is one of a long and growing list of parts formerly made from castings or forgings that have been redesigned for EASY-FLO brazed construction.

The reasons so many are changing to EASY-FLO brazed construction are—faster production—elimination of machine operations—reduction in weight—metal saving—and last but not least, low costs.

EASY-FLO IS THE KEY to the success of this low-temperature silver alloy brazed construction, because it makes joints that are as strong as solid metal—and makes them fast, reliably and at surprisingly low cost per joint.

You will find interesting details about it in **Bulletin No. 12.** Also valuable information on joint designs, heating methods and fast production procedures. A copy will be mailed to you on request—write for it now.

EASY-FLO BRAZING IS HERE TO STAY. *The exceptional speed, reliability and economy EASY-FLO brings to the joining of both ferrous and non-ferrous metals account for the phenomenal spread in its use on war production and assure an increasing use in peacetime manufacturing. Get the facts in Bulletin No. 12-A. Plan to use it in your post-war production.*

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DISTRICT OFFICES
3348 S. Pulaski Road Chicago, Illinois Milwaukee

Clarify Restrictions on Alien Employment

A joint statement issued by the Secretary of War, the Attorney General, the Secretary of the Navy and the Chairman of the Maritime Commission clarifies the confusion which has hitherto existed regarding the employment of aliens by Government contractors and subcontractors.

Contractors and subcontractors, says this statement, are required to obtain the written consent of the head of the Government department concerned before employing aliens under the following conditions only:

"(*a*) *Aeronautical contracts.* — Written consent is required before an alien employee may be permitted to have access to the plans or specifications or the work under construction or to participate in the contract trials under contracts involving aircraft, aircraft parts, or aeronautical accessories for the United States.

"(*b*) *Classified contracts.*—Written consent is required before aliens employed by a contractor in the performance of secret, confidential or restricted Government contracts shall be permitted to have access to the plans or specifications or the work under such contracts or to participate in the contract trials."

Except under the specific conditions specified above, War and Navy Department and Maritime Commission contractors and subcontractors may employ aliens as freely as American citizens.

In order to obtain consent of the head of the Government department concerned, for the employment of an alien on an aeronautical or classified contract, the alien and the contractor are required to fill out their respective parts of an Alien Questionnaire Form. This form may be secured from the plant security officer or from the local office of the United States Employment Service.

» «

WPB Amends Order L-318 on Spot Welding Electrodes

Amendment 1 to General Conservation Order L-318, covering spot welding electrodes, was issued on Sept. 30 by the War Production Board to correct an error in the definition of Morse taper fittings. The amendment deletes any allowable tolerance from the definition of taper per foot.

Order L-318, effective Oct. 7, restricts the use of certain critical materials in the manufacture of spot welding electrodes and endeavors to simplify and standardize practices. Specifications are given for electrode tips, lengths and maximum diameters in this limitation order, which also prohibits the use of tungsten and molybdenum except in electrode facings and inserts.

» «

Handy & Harman Holds Clam Bake for Employees

An old fashioned New England clam bake, complete with clams, chicken, corn, lobster, potatoes and all the trimmings, was staged recently by Handy & Harman at its Bridgeport, Conn., plant for 650 employees and guests. On this occasion, the company's 180 men in the Armed Forces were honored by the unveiling of a sterling silver Honor Roll Tablet, and lapel pins were presented to employees who had completed many years of faithful service with the company. As a surprise announcement, it was revealed that Handy & Harman had just received its third Army-Navy "E" Award for the outstanding production of war materials.

» «

New Welding Mfgr. and Distributor

E. A. Randall, formerly of Philadelphia, has organized the Welding & Cutting Materials Co., 400 East 18th St., Kansas City 8, Mo. This firm manufactures the Ran-Cutter-Universal cutting torch guide and acts as distributor for Rego welding equipment. General repair work on all makes of welding and cutting equipment is also done.

» «

Correction on NE Steels

American Iron and Steel Institute advises that the manganese content of NE 9260, NE 9261 and NE 9262 should read 0.70-1.00% instead of 0.75 to 1.00% as stated in Engineering Data Sheet No. 37, page 79 of the October issue of THE WELDING ENGINEER.

MANGANAL

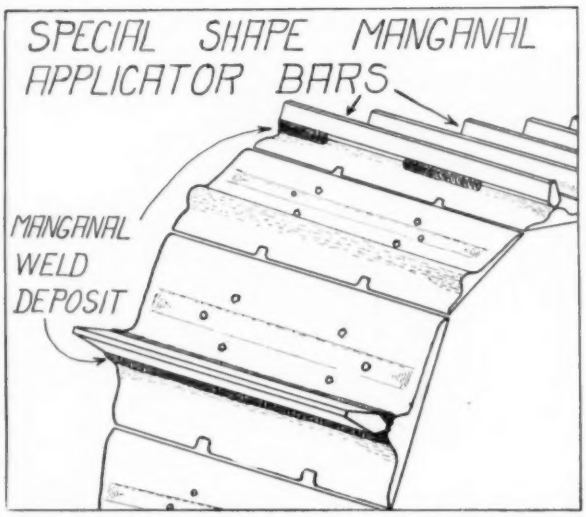
(Reg. U. S. Pat. Office. U. S. Patents 1,876,738—1,947,167—2,021,945)

SPECIAL SHAPE

APPLICATOR BARS

FOR

TRACTOR GROUSER RE-TREADS



MADE IN FIVE SIZES EASILY WELDED TO ANY SHAPE OR SIZE GROUSER. PROVIDES A RE-TREAD FOR ALL TRACK LAYING TYPES OF EQUIPMENT.

Attach with Manganal Bare or Special Tite Kote welding electrodes.

Applicator bars are manganese nickel steel, the toughest metal known. Work hardens under impact and abrasion.

New parts are difficult to obtain. Saves approximately 80% of the metal of a new part, as well as time and money.

150 Distributors Are Ready to Serve You

Sole Producers

STULZ-SICKLES COMPANY

134-142 Lafayette St., Newark, N. J.

Try Seaco Hard Surfacing Over Manganese Weld Deposits

Ransome Consolidates with Worthington Pump

Ransome Machinery Co., Dunellen, N. J., has become a wholly-owned subsidiary of the Worthington Pump and Machinery Corp., Harrison, N. J. The consolidation brings together two important lines of construction and general industrial equipment. In the welding field, Ransome manufactures welding positioners and welding turning rolls.

» «

Don't Penalize Incentive, J. F. Lincoln Tells House

The Treasury Department's "bureaucratic policy" is endangering the war effort, J. F. Lincoln, president of The Lincoln Electric Company, opined in testimony presented before the House Committee on Ways and Means at its request.

"In spite of the fact that the caste system has failed utterly throughout the rest of the world, the Treasury Department forces it by the policy announcement that no man who works with his hands may receive a salary of $5,000 per year, regardless of his efficiency, ability and coöperation," said Mr. Lincoln.

"Penalizing incentive cannot do otherwise than eliminate American efficiency of industrial production. It will kill the hope of victory by causing waste of lives, production of ability and materials. It will kill hope of a high standard of living after the war. . . .

"This penalty on loyal, patriotic effort could be called treason in time of war since all-out production is vital to victory. Such interference would be called sabotage if caused by our enemies. It is actually bureaucratic insistence on fitting all industry to a single preconceived formula with a lack of understanding of the industrial system. Obviously, no one formula can possibly apply properly in all cases."

» «

Stress Analysis Society to Meet in New York City

A joint meeting of the Society for Experimental Stress Analysis with the Applied Mechanics Div. of the American Society of Mechanical Engineers will be held at the Hotel Pennsylvania, New York City, December 2-4, 1943. Inquiries should be addressed to the Society for Experimental Stress Analysis, P.O. Box 168, Cambridge 39, Mass.

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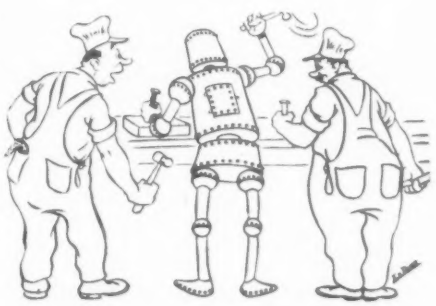

"I hope Joe gets well soon—this new man's good, but he doesn't have Joe's sense of humor."

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P&H WELDING POSITIONERS
FOR INCREASED WELDING PRODUCTION
LOWER WELDING COSTS

New—more versatile—designed and built for today's welding requirements! P&H Welding Positioners provide Dual Capacity design for handling two classes of work—more easily and quickly. They enable operators to greatly increase arc time.

Let a P&H Welding Positioner help you speed up production and lower your welding costs. They are available in a complete range of capacities. Write today for literature describing the complete line.

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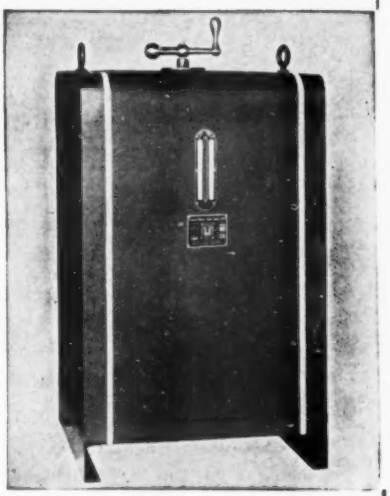
P&H WELDING POSITIONERS

P&H is America's only manufacturer providing a complete welding service including A.C. and D.C. Welding Machines, Electrodes, Production Welding Control Systems, Welding Positioners, and "Thru-the-Air" materials handling equipment.

Canadian Distribution: The Canadian Fairbanks-Morse Co., Ltd.

WELD FASTER and CHEAPER
With TRANSFORMER TYPE A. C. ARC WELDERS



Get 15-25% faster welding with improved weld deposits. Your labor costs are cut because of greater speed in depositing weld metal, lack of magnetic blow, deeper penetration. You can use larger electrodes and get more feet of weld per hour.

Available for manual or automatic welding. The Universal A.C. Arc Welder is more economical in use of current. Electrode costs are cut by using larger sizes, by reducing stub losses. You avoid maintenance costs because there are no moving parts, nothing to wear out.

HIGH POWER FACTOR "BUILT-IN"

You benefit from reduced power cost. Power factor correction reduces K.V.A. by about 1/3, and decreases demand charges proportionately, at same time giving a high percentage of power factor.

UNIVERSAL POWER CORP.
4899 Euclid Ave., Cleveland, Ohio

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Universal Power Corp.—4899 Euclid Ave. Cleveland, Ohio
Gentlemen:
Please send new catalog, giving full details and prices on transformer type arc welders and your full line of equipment and accessories.

NAME.....
ADDRESS.....
CITY.....STATE.....

ABOUT PEOPLE

Owen L. Holland, formerly chief of the Welding, Electroplating and Equipment branch of WPB, has been appointed Chicago district manager for the welding division of Metal and Thermit Corp. Mr. Holland was at one time general sales manager of the Hollup Corp., manufacturer of welding electrodes and accessories, but left this firm to establish his own business, handling welding specialties. Subsequently, he was called to Washington to head the WPB welding branch.

» «

Thomas J. McKay, formerly president and treasurer of The McKay Co., Pittsburgh, has been elected chairman of the board of directors. **James C. McKay,** formerly vice-president, has been advanced to the offices of president and treasurer.

» «

R. S. Arnold has been appointed assistant to M. R. Minnich, sales manager of the American Welding and Mfg. Co., Warren, O. Mr. Arnold was formerly manager of the Ideal Foundry Div. of the Republic Steel Corp., Newton Falls, O.

» «

Howard W. Bennett has been made manager of the specialty division of the General Electric Company's Electronics Department and will be responsible for the engineering, manufacturing and sales operations of this division. Mr. Bennett has been with General Electric since 1930.

» «

J. Frederic Wiese, formerly assistant to vice-president in charge of sales of Lukens Steel Co., Coatesville, Pa., has been elected vice-president of this company and given charge of the combined sales of Lukens and its two subsidiaries, By-Products Steel Corp. and Lukenweld, Inc.

» «

Edward K. Myers, who has been credit manager for Lukens Steel Co. and its subsidiaries, was recently elected assistant treasurer.

» «

D. Earl McElroy has been appointed special mill representative on the Pacific coast for Lukens Steel Co. and its subsidiaries, By-Products Steel Corporation and Lukenweld, Inc., Coatesville, Pa. He will act in a liaison capacity between the Lukens companies and C. T. Hansen & Co., Pacific coast sales representative of Lukens and its subsidiaries.

» «

After 63 years of consecutive service, **Charles Buckingham** retired at the age of 79 from the Seymour Mfg. Co., Seymour, Conn., manufacturer of phosphor-bronze welding rods and other non-ferrous alloys. Mr. Buckingham had served this company as shipping clerk for 60 years.

» «

Van S. Wielosinski has been appointed plant metallurgist at Willys-Overland Motors. Mr. Wielosinski was formerly with the Carnegie-Illinois Steel Corp., Chicago, where he was engaged for seven years in metallurgical research.

» «

Charles F. Dickinson has been appointed assistant manager, metallurgical division, Carnegie-Illinois Steel Corp., Chicago, to succeed **L. L. Rohl,** recently advanced to the position of manager. Mr. Dickinson has been connected with the company since 1937 when he began as assistant to the general superintendent at the Gary Sheet and Tin Mills. Last March, he was transferred to Pittsburgh as metallurgical engineer in charge of sheet and strip products.

» «

Gwilym A. Price, formerly president of the Peoples-Pittsburgh Trust Co., has been elected a vice-president of the Westinghouse Electric and Mfg. Co. His new responsibilities will include the settlement of war contracts.

IT'S *Quicker* TO USE A

CMD *Triple Duty*

CHIPPING HAMMER

Triple Duty TYPE CB

3 tools in one. Brush replaceable when worn. Well balanced. Weight 1 lb.

This convenient tool has a chisel in one end of the head and a drift in the other and a removable wire brush on the end of the handle. The user does not have to set aside the rod holder to chip or brush away slag from the weld. This model is one of many in the CMD line famous for quality for 22 years. Write Department 11W for latest circular for complete details.

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"FLAME THROWERS"

Vital Weapons of the Shop Front

Cutting through metals with a superheated flame, "Gasweld" Cutting Torches give finest results on light metals as well as on the heaviest cutting job.

Light weight and perfect balance reduce operator fatigue to a minimum—an important feature for today's hard pressed conditions—yet the rugged construction of these torches is designed to withstand hard daily usage. Exclusive "Free Flow" design eliminates completely the danger of flashback.

For full explanation of special features write for Welding and Cutting Equipment catalog.

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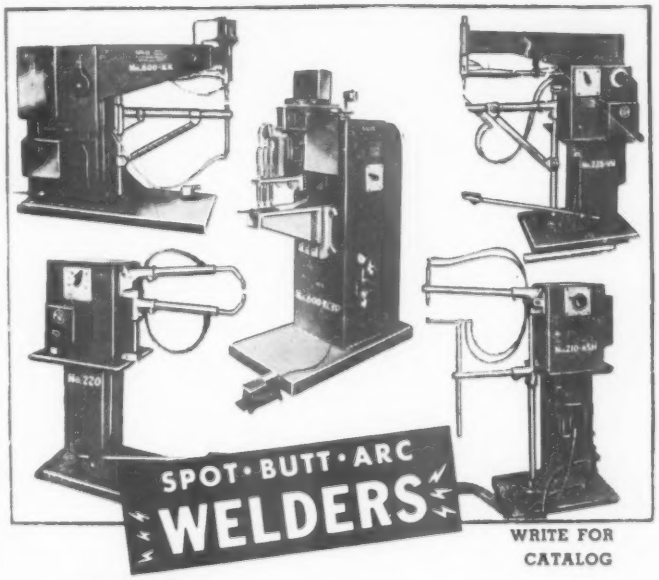
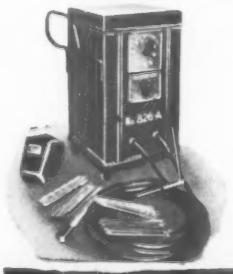


SPOT · BUTT · ARC
WELDERS

WRITE FOR CATALOG



We manufacture a complete line of resistance spot welders from ¼ to 300 KVA for all types of welding. There is an EISLER WELDER for every purpose.

TRANSFORMERS OF ALL TYPES

WE INVITE CONTRACT SPOT WELDING IN LARGE OR SMALL QUANTITIES.

CHAS. EISLER
EISLER ENGINEERING CO.
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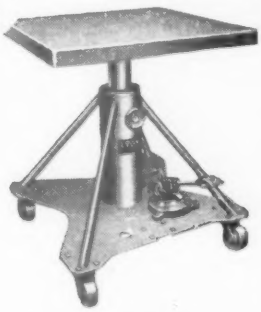
For . . . 1. Handling dies.
2. Elevating or revolving work to convenient positions for welding.
3. Transferring heavy parts from one level to another level.
4. Supporting overhanging work.
5. Bringing work to convenient heights for the operator.
6. Other operations where table-revolving and easy foot-actuated elevation are advantageous.



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Hydraulic ELEVATING TABLE

On scores of different material handling jobs, the LYON Hydraulic Elevating Table saves time, increases safety, eliminates need for helpers. Lifts up to a ton to any height from 29" to 43".

Now available in portable and stationary types. New optional features, such as indexing device, retaining bars, floor lock, towing handle, 2-speed pump may be mounted when required. Write today for latest descriptive material.

● Also designers and manufacturers of Specialized Material Handling Equipment.

LYON-Raymond Corporation
MATERIAL HANDLING EQUIPMENT
282 Madison St., Greene, N. Y.

Helpful Literature Just Published

The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

Shipyard Welding Book

A 54 page, 6 by 9 in. booklet titled "Welding Instructions" has just been published by the U. S. Maritime Commission for use by welding supervisors and leadermen of crafts concerned with shipyard welding. This booklet presents a standard system of welding practices to be adopted by all branches of the shipbuilding industry. Its material was compiled from the experiences of a representative body of men active in merchant and naval shipbuilding and from the records of common failures (on ships during the construction period) attributable to welding procedures.

The topics covered include: the qualification and duties of welding supervisors, the importance of making sound welds, design details, standard shipyard procedure, welding sequences for various ship sections, failures due to improper sequences, preparation of subassemblies for welding and erection, joint details, erection procedure, butt welds, fillet welds, fittings, precautions to be taken in welding material over 1½ in. thick, use of automatic welding, precautions to be taken when welding in cold weather, electrode storage and handling, fairing, sequences for welded repairs.

In a brief introduction addressed to all contractors constructing ships for the United States Maritime Commission, Rear Admiral Howard L. Vickery, vice-chairman of the Commission, points out that inexperienced or poorly skilled welding supervisors and operators can upset production schedules, run up excessive man-hours because of work that has to be chipped or burned out and rewelded, and endanger the ship through poor workmanship. "It has become obvious," he declares, "that a comprehensive analysis should be made of the common welding difficulties encountered in building ships and that an authoritative set of instructions as to what should be done and what should be avoided ought to be issued for the benefit of all shipyards and their production organizations."

A copy of "Welding Instructions" may be obtained by writing to Jack Wolff, Div. of Shipyard Labor Relations, **U. S. Maritime Commission,** Washington 25.

» «

Apprentice-Training Pamphlets

Two pamphlets on different aspects of apprentice training have been published by the **Bureau of Training of the War Manpower Commission,** Washington, D. C. One of these, "Training Apprentices for War and Postwar Work," is a reprint of an article in *Factory Management and Maintenance* by A. Goodwin, director of apprenticeship training for the Murray Corp. of America.

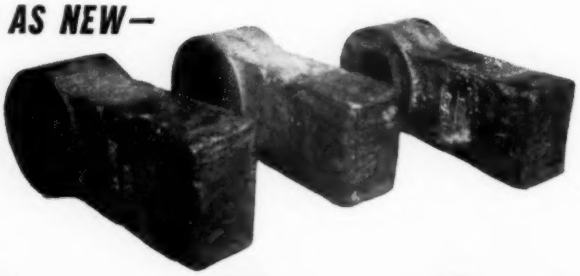
The other booklet, "Machinist Apprenticeship Standards," reproduces the standards which were jointly adopted by representative employers and the International Association of Machinists in the St. Louis area. This information is presented as a guide for interested groups and individuals to the setting up of a thorough step-by-step system for the training of all-round skilled workers in any trade.

» «

Electronic Heating Booklet

The electronic heater, which now makes possible many new applications of the principles of induction heating, is featured in an eight-page, letterhead-size bulletin, GEA-4076, recently issued by the **General Electric Co.,** Schenectady, N. Y. This publication gives specifications for G-E's 5 kw and 15 kw, 550 kilocycle electronic heaters and includes two pages of pictures of various small parts which have been successfully brazed, soldered or surface hardened by electronic heating.

NOT GOOD AS NEW—



But Several Times Better

YOU COULDN'T imagine tougher working conditions than the severe shock, impact and abrasion to which these foundry hammers are continually subjected. But, now that they are protected with the super-wear-resistance coating of Coast Metals Hard-Facing, they have what it takes to keep going! And last several times longer than uncoated hammers!

Coast Metals Hard-Facing makes possible fewer equipment shutdowns, less idle labor, conservation of critical metals, salvage of worn parts and maximum equipment output. Not only for foundry hammers, but also for hot shear blades, slag buckets, tong grips, mill guides, and innumerable other products, machines and equipment!

Coast Metals can be welded either by the electric arc or the acetylene torch to all ferrous metals, including manganese steel, alloy steel, cast iron and chilled iron. New booklet, "Your Best Protection Against Wear" *free* on request. Write for your copy *today.*

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COAST METALS *hard-facing weld rods*

MAKE YOUR EQUIPMENT LAST LONGER

THE FIRE-BIRD HAS MET HIS MATCH!

The Fire-Bird was a legendary fire-bug-with-wings whose specialty it was to light the dangerous gases present in the deep passages of coal mines causing many deadly explosions and painful burns.

Cofen is a proven remedy for burns, going from shop to shop to relieve pain, clean wounds and help to avoid infection. In Cofen the Fire-Bird of legend has met its modern match. Cofen is a "must" in all shops.

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SOUTH NORWALK, CONN.

TRUE DRILLING
in the Tight Spots with . . .

STOW

FLEXIBLE Drill-Shafts

● A Stow Flexible Drill-Shaft, attached to any electric or pneumatic hand drill, relieves the operator from manipulating bulky, heavy power tools in close quarters—enables him to drill *true* holes *fast* in spots the regular drills can't reach. With easy, one-hand operation, fatigue is minimized—accuracy maintained—output increased.

● Stow Flexible Drill-Shafts come equipped with straight spindle, 45° or 90° angle heads.

● 68 years of leadership in designing and manufacturing flexible shafts for many industrial applications assure you of dependability and endurance when you specify STOW.

Ask for literature giving standard sizes and capacities to meet your requirements.

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Krembs Fluxes Go Farther

Krembs fluxes go farther than competing fluxes, thereby reducing the cost per foot. Pound for pound, or dollar for dollar, they turn out many more lineal feet of weld or braze. Try them and see.

The consulting welding and brazing engineers of the Krembs organization have specialized in fluxes for welding, brazing, and silver soldering since 1895. They have developed 89 different non-bubbling, quick flowing Fluxine Fluxes each for specific jobs. They'll study your metal joining problems . . . recommend the proper flux . . . and send free samples with instructions.

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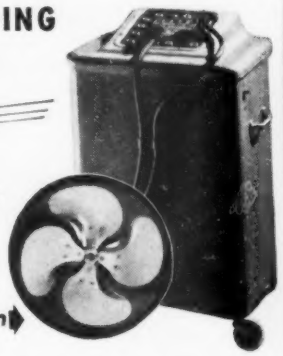
CHEMISTS AND METALLURGISTS SINCE 1875

FLUXINE

TRADE MARK REGISTERED U.S. PAT. OFF.

FLUXES TO JOIN ALL METALS

CONTINUOUS WELDING NOW JUST A BREEZE



New Ergolyte A.C. Arc Welder Especially built for Continuous War Time Duty

Air Cooled by Powerful Fan

Our fighting men need the stuff. They can't wait while naturally cooled machines "cool down". That's why we built into the new Ergolyte 250F a powerful cooling fan, added extra-heavy insulation. Avoid time delays, danger from burning out due to heat stress. Speed up war work. Make your next welding machine an Ergolyte 250F. Write for information today.

SPECIFICATIONS

Current Range: 15 250 Amp. Input Voltage: 230-460 Volts. Frequency: 60 cycles or to order. Phase: Single or operates on one phase of 2 or 3 phase current. Electrode size Range: 1/16"—3/16". Heat Steps: 24. Size: 18" x 12¼", height 21½". Weight: 215 lbs.

GUARANTEED ONE YEAR

ERGOLYTE MANUFACTURING COMPANY

3629 NORTH LAWRENCE STREET, PHILADELPHIA, PENNA.

Heat-Treating Atmospheres

The four basic gases for providing the proper atmosphere for any heat-treating process are described in a new 16-page, letterhead-size booklet, "Westinghouse Heat-Treating Atmospheres." These four gases—Endogas, Exogas, Monogas and Ammogas—provide nine variations from which the proper atmosphere may be selected for annealing, brazing, hardening, tempering, gas carburizing, sintering, normalizing, etc. The book explains the chemical reaction, composition cost, application and equipment needed for each atmosphere. Typical furnace applications are illustrated, and schematic arrangement and flow diagrams given for an endogas generator, an exogas generator, a carbon dioxide remover for monogas, and an ammonia dissociator. A chart of the combustion properties of fuel gas is also included, and a table is given showing the atmospheres suitable for the various heat-treating operations on different metals.

Copies of this booklet, B-3251, may be secured from Dept. 7-N-20, **Westinghouse Electric and Mfg. Co.,** East Pittsburgh, Pa.

» «

Fire Prevention Booklet

"Preventing Welding and Cutting Fires" is the title of a 16-page, 4¾ by 6¾ in. booklet prepared to instruct users of welding and cutting equipment in the precautions to be taken to eliminate fire losses. Though much of the material contained in this booklet is well known to weldors, the book is valuable as a means of educating new workers in the approved methods for handling welding and cutting torches, oxygen, acetylene cylinders, etc. Ten simples rules are given for preventing fires and three rules for extinguishing fires. Reasonable quantities of this booklet may be obtained without charge from the **International Acetylene Association,** 30 East 42nd St., New York 17.

» «

Maintenance Handbook

The new 88-page Ideal maintenance handbook No. 143 gives helpful information on how to keep motors and generators operating continuously at peak efficiency without dismantling them. Other equipment is also covered, including industrial electrical equipment, variable speed transmissions, machine tool accessories, wiring devices and tools, etc. **Ideal Commutator Dresser Co.,** Sycamore, Ill.

» «

Pneumatic Tool Catalog

Dallett Bulletin No. 500 is an eight-page, letterhead size catalog of pneumatic tools and other accessories for industrial welding. These accessories include air-operated scaling and chipping hammers as well as hand scaling picks and shank chisels. Hose couplings, hose fittings and a detachable welding cable connector are also pictured and described. **The Dallett Co.,** Mascher at Lippincott St., Philadelphia.

» «

Welding Pictorial

No. 34 in the series of Progressive monthly "Welding Pictorials" pictures a new line of rocker arm welders for aluminum welding, a "shrink-fit" resistance welder designed to shrink mounting brackets on the axle shafts of military vehicles, a "push-gun" developed for light gauge aircraft welding, a seam welder being used to weld housings of land mines and a portable air-operated seam welding gun. **Progressive Welder Co.,** 3099 East Outer Drive, Detroit 12.

» «

Carbon Brush Standards

NEMA Publication No. 43-85, "Carbon, Graphite and Metal-Graphite Brush Standards," has been issued to supersede the previous standards issued in 1934. This 16-page pamphlet is devoted to standard dimensions and tolerances for carbon, graphite and metal-graphite brushes and standards for associated parts of brushes such as shunt cables, clips and connections. An entire section is given to definitions for brushes. Available at 25c per copy from the **National Electrical Manufacturers Association,** 155 East 44th St., New York City.

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OLD WELDING
and CUTTING TIPS
for Reconditioning
Don't throw away your old worn out welding and cutting tips—send them to us and we will recondition them. We can salvage up to 70% of all tips sent to us. Here is a chance for you to help conserve on critical material by re-using the tips you thought were beyond repair. Send your order in today, it will receive prompt attention.
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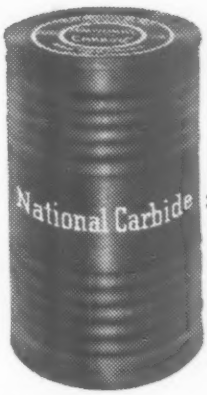

For
Welding and Cutting
Specify
NATIONAL CARBIDE IN THE RED DRUM

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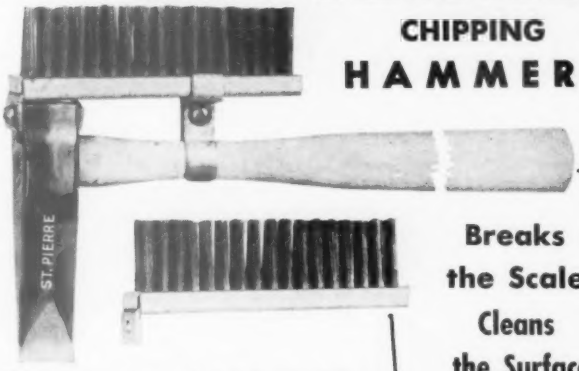
NATIONAL CARBIDE CORPORATION
60 E. 42nd St., New York, N. Y.

ABUSE MEANS NOTHING TO ST. PIERRE

CHIPPING HAMMERS



Here's a man-sized brush in the right position for easy use after chipping scale from welded surface. Hammer-Chisel made of highest quality tool steel. Entire tool is well-balanced. For economy, for durability use ST. PIERRE Hammers.

Breaks the Scale
Cleans the Surface
in One Operation

Order Today From Your Jobber or Direct

ST. PIERRE Chain Corporation
WORCESTER DROP FORGINGS MASSACHUSETTS

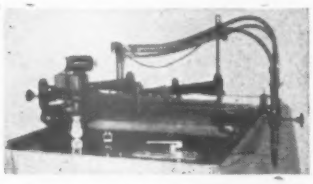
HELP SAVE STEEL
BY APPLYING WIESE UNITS TO AGRICULTURAL TOOLS
Prepare your shop for this type of work
U. S. Patents 2,013,818, 2,051,234 and 2,226,984.

ELECTRIC WELDED
Write for new catalog now
WIESE PLOW WELDING COMPANY, PERRY, IOWA
Originally New Process Plow Welding Co.

AUTOMATIC SHAPE CUTTING MACHINES

Popular models and sizes. Gas and electric welding supplies; TIPS for various makes of torches. Safety Equipment and Clothing.

Large stocks—prompt deliveries.



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FASTER BETTER WELDING WITH THE MISSING LINK

Quick Shipments
on AA-5 PRIORITY or HIGHER $59.50 COMPLETE

STARTS THE ARC AUTOMATICALLY AND KEEPS IT GOING! Attach the Missing Link Automatic Arc Hy-Cycle Unit to your AC or DC arc welders. Then see how much more quickly each welding operation is completed. Note too, the improvement in each weld. But that's not all! With the Missing Link, even untrained beginners can do a good job of welding right from the start . . . important business indeed during these days of speed and skilled help shortages.

We urge you—equip with this tried and proved product and get the best in welding today.

If it's a welding problem we can help you.

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ON
TRINDL SUPER INDUSTRIAL **ARC WELDER**
DESIGNED FOR HIGH SPEED PRODUCTION ARC WELDING

TRINDL SUPER INDUSTRIAL ARC WELDERS, the result of many years of careful engineering and "job tested" research, are rolling up impressive production records. Acclaimed for superior performance, ruggedness, dependability, and economical operation.

For better, faster welding, easy-to-operate TRINDL SUPER INDUSTRIAL ARC WELDERS will help step up your production schedules 20% to 40%. Manufactured in a range of distinctive sizes to accommodate every type of shop and production welding job.

Trindl Welders, Electrodes, supplies and accessories, available for immediate delivery, will save you both time and money. Write, wire or phone for full details.

TRINDL PRODUCTS, LTD. 2227-AR CALUMET AVE. CHICAGO 16, ILL.

Saved...
up to 160 MAN-HOURS per Welder Unit*...

... with BADGER D-C Generator Welder FILTER

IN ONE LARGE WAR PLANT (name on request) process and atmospheric dusts drawn into Generator Welders caused an average of FOUR "down-times"* per year for repair and overhauling—lost up to 160 MAN-HOURS per unit!

BADGER D-C Generator Welder PERMANENT FILTERS were installed. Since then, over four years ago, not ONE Welding Unit has been out of operation for repair caused by process and atmospheric dusts. Savings in Man-Hours, Money and Lost Production time more than paid the cost of each BADGER PERMANENT FILTER during the first year.

You, too, may enjoy similar benefits on YOUR Generator Welding Units! The BADGER Permanent-type Filter is easy to install—and inexpensive. Write for information TODAY! Send us the complete information to identify the make, style and model of Welder used.

* "Frozen" or clogged rotors—Excessive wearing of generator and Excitor Brushes, based on an average of 7488 machine hours per year.

Badger MANUFACTURING & SALES COMPANY
335 EAST BROWN STREET
MILWAUKEE 12, WISCONSIN

Manufacturers of PERMANENT Filters for Heating, Ventilating, Air Conditioning Aircraft and Industrial use

"Tantung" Tool Catalog

An extensive line of solid tool bits, cut-off blades, milling cutter blades, shell and solid end mills, boring tools and rounds, forming tools, etc., is presented in the new 28-page "Tantung Tool Catalog" just issued by **The Vascoloy-Ramet Corp.**, North Chicago, Ill. These tools are of "Tantung," trade-name of a non-ferrous cast alloy for metal cutting. Tantung was developed to fill the gap between conventional high-speed steel tools and cemented carbides, and its basic formula includes tantalum carbide, which is said to impart a self-lubricating action to the tool.

Comprehensive instructions for grinding Tantung and for brazing (oxy-acetylene) tips of this material to tool shanks are given in this booklet.

» «

Positioner Bulletin

A new four-page, letterhead-size bulletin, No. 201, has been issued to present in concise form the full Ransome line of welding positioning equipment, which ranges in capacity up to 20 tons. Specifications, important features, load rating tables and dimensions are included. **Ransome Machinery Co.**, Dunellen, N. J.

» «

Coolant Bulletin

A two-page bulletin, No. 75-AC, covering the new "Frostrode" coolant cooler has just been released by **Frostrode Products**, 19003 John R. Street, Detroit 3. The bulletin describes a line of portable refrigerating units designed to provide accurate temperature control of coolants and lubricants in machine processing. Elimination of work distortion due to the frictional heat developed in grinding, cutting, turning and similar operations is now possible, it is claimed. The bulletin includes complete specifications and an illustration of a typical installation.

» «

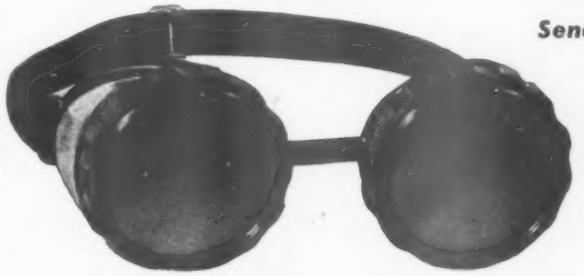
Connector Catalog

A four-page, letterhead-size folder, No. 424-43, describes the Palmgren line of welding cable connectors, including the "Rapid" connector, which may be connected or disconnected at a twist of the wrist. Other cable connectors are of the straight, angle, bus, panel, and multiple types. **Chicago Tool and Engineering Co.**, 8383 South Chicago Ave., Chicago.

» «

Air Conditioning Booklet

A 20-page booklet, 3AC-0201, has been issued to show how air conditioning and industrial refrigeration may be used to solve production problems in spot welding, X-ray film developing, machining work, instrument assembly and other industrial processes. The book includes explanations and diagrams of air conditioning principles and illustrates the company's line of equipment. **Westinghouse Electric and Mfg. Co.**, East Springfield, Mass.



METRO'S Welding and Grinding Goggles

Send for new catalog

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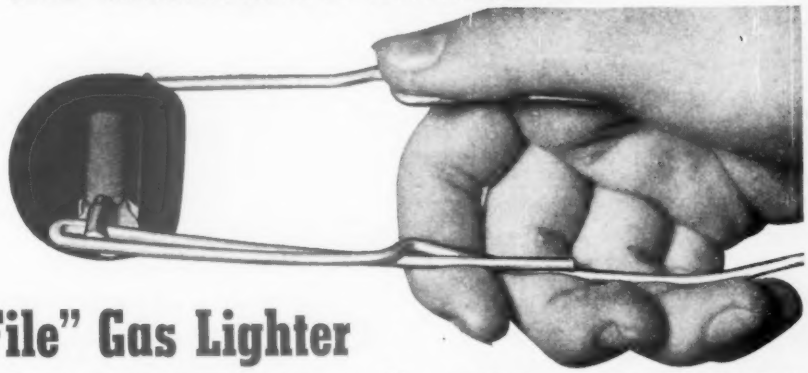

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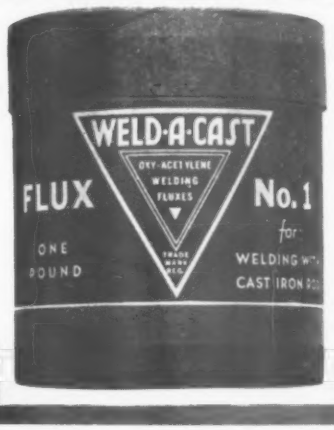

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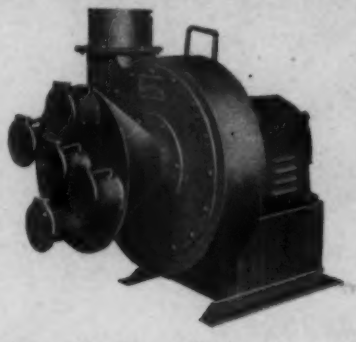

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FROM THE PATENT OFFICE

Resistance Welding of Copper

2,330,943. **Philip P. Anderson, Jr.,** and **Ralph M. Major,** Evansville, Ind., assigned to **Servel, Inc.,** New York City. Filed Nov. 28, 1941. Issued Oct. 5, 1943.

A method by which resistance welding may be used to weld together pieces of copper. In this method, a coating of iron of uniform thickness and desired porosity (which determines the resistivity of the iron coatings) is formed by electrodeposition on a surface of each of the copper pieces. The pieces are then held together with their iron coatings contacting while welding current is passed through them for resistance welding.

» «

Flame-Gouging Method

2,329,270. **Everett P. Jones,** Elizabeth N. J., assigned to **The Linde Air Products Co.** Filed March 7, 1941. Issued Sept. 14, 1943.

A method of forming a shaped edge on a metal member to prepare it for welding. Flame-cutting is used to sever a portion from the member by cutting lengthwise of an edge face. The cut surface slopes outwardly from one main face of the member to a point on the edge face adjacent the other main face. A groove is then formed along and in the cut surface.

» «

Manganese Steel Welding

2,329,410. **Raymond L. Morrison,** Buffalo, N. Y., assigned to the **Morrison Railway Supply Corp.,** Buffalo. Filed April 25, 1940. Issued Sept. 14, 1943.

A process of arc welding manganese steel using a manganese steel electrode of an austenitic structure. The electrode is composed of from 5% to 20% manganese, from 1% to 5% copper, from 0.1% to 2% carbon, from 0.1% to 2% silicon and the balance essentially iron. The deposited metal is peened before it has cooled to a temperature below 750 F in order to prevent the formation of checks and cracks.

» «

Carbon-Arc Welding Method

2,330,601. **Bernard M. Larsen,** Elizabeth, N. J., assigned to **United States Steel Corp.** Filed April 22, 1942. Issued Sept. 28, 1943.

A method of arc welding low-carbon steel with a carbon electrode. The method is characterized by covering the welding zone with an oxidizing slag (through which the arc is worked) to prevent the steel from permanently acquiring carbon from the electrode.

» «

Autogenous Welding Method

2,330,503. **Antonio Longoria,** South Euclid, O. Filed April 3, 1942. Issued Sept. 28, 1943.

A method of autogenous (without the supplying of additional metal) arc welding. A relative movement between juxtaposed pieces of work and a circular electrode is effected, and a unidirectional electric current flow is established across an arc between electrode and the work. The arc causes the electrode to rotate in the direction of movement of the work. To stabilize the arc while the work pieces are being autogenously welded together, a gaseous fluid is directed onto the electrode at the point of source of the arc and in a direction opposed to that in which the work is traveling and substantially perpendicular to a line passing through the welding arc normal to the work.

» «

Automatic Switch for Welder

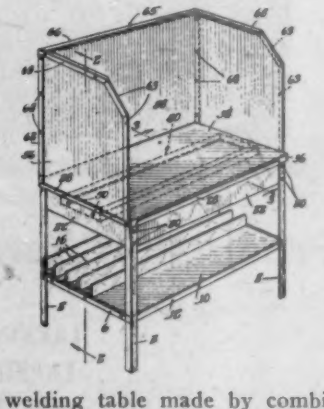
2,328,596. **Thomas W. Winsor,** Bremerton, Wash. Filed Jan. 23, 1936. Issued Sept. 7, 1943.

An automatic start-stop switch for an arc welder motor-generator. Included are means responsive to the grounding of one terminal of the generator for closing the switch, means responsive to the flow of current from generator for maintaining switch closed and means responsive to the cessation of the flow of current from generator for a predetermined length of time for opening the switch.

» «

Welding Table

2,328,182. **James E. Bales,** Aurora, assigned to **Lyon Metal Products, Inc.,** Aurora, Ill. Filed Oct. 27, 1941. Issued Aug. 31, 1943.



A welding table made by combining four vertically extending angle irons with flanges 90 deg apart; the angle irons are used to form the four vertical legs of the table. Four vertical sheet metal panels are connected to the flanges of the leg members, the upper portions of these panels providing horizontally extending ledges.

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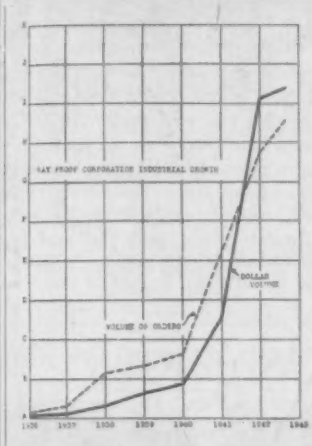

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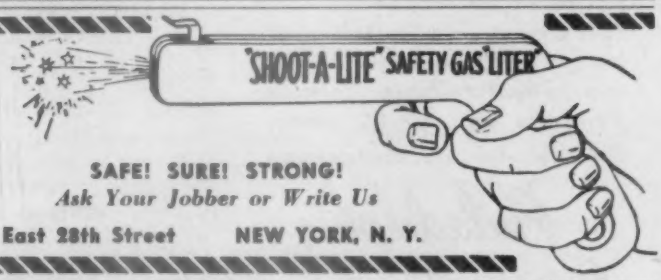

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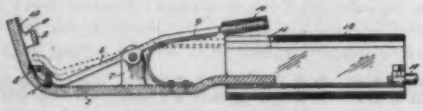
Headband

2,328,042. **James Wilson Welsh,** Providence, R. I., assigned to **The Welsh Mfg. Co.,** Providence. Filed April 28, 1941. Issued Aug. 31, 1943.

In this split headband, the upper corner of one end and the lower corner of the other end are each provided with an extension of smaller width than the width of the body portion of headband. The outer boundaries of these respective extensions are continuations of the respective outer boundaries of the body portion of the headband. The extensions are disposed in lapping relation side by side along their widths and are relatively adjustable longitudinally to permit adjustment of the size of the headband. A sleeve enclosing the lapping extensions may be clamped against them to secure the extensions in their adjusted positions.

» «



Electrode Holder

2,327,290. **William Rice,** Aldan, Pa. Filed June 29, 1942. Issued Aug. 17, 1943.

An electrode holder with a bar that is fixed to the handle and has its forward end curving upwardly. Bar is provided with a groove on its inner face and an apertured head inwardly of and merging into this groove. A clamping lever is fulcrumed on the bar and has its forward end adapted to clamp an electrode against bar inwardly of its head. A spring tends to retain the clamping lever in the unclamped position.

» «

Pipe Welding Mill

2,327,318. **William Rodder,** Youngstown, and **James H. Hopkins,** Alliance, O., assigned one-half to **The Aetna Standard Engineering Co.,** Youngstown, and one-half to **S. F. Keener,** doing business as the **Salem Engineering Co.,** Salem, O. Filed May 15, 1940. Issued Aug. 17, 1943.

A continuous pipe welding apparatus having a strip heating furnace, a rail extending away from strip outlet of furnace, a frame structure supported on this rail for sliding adjustment toward or away from outlet, means for locking frame in adjusted position, a pair of forming rolls carried by frame in horizontal alignment with outlet, a motor mounted on frame, driving connections from motor to forming rolls and a pair of fixed pipes adapted to discharge air against the opposite edges of the strip as it leaves the furnace and before it enters the forming rolls.

» «

Pipe Fitting

2,329,956. **Edward Hall Taylor,** Chicago. Filed Feb. 13, 1942. Issued Sept. 21, 1943.

A fitting for securing to an unthreaded pipe end by a metallic bond between the two. The fitting has an end portion with ID slightly greater than the OD of the pipe end, and this end portion is provided with inwardly projecting helical elements forming teeth that decrease in height toward the outer end of the end portion. Upon insertion of the pipe into the fitting, it is gripped and held by the teeth. Since the latter are spaced inwardly an appreciable distance from the end of the fitting, an unobstructed space is provided for the free flow of metal between the pipe end and the end portion of the fitting. Thus the pipe and fitting may be welded together.

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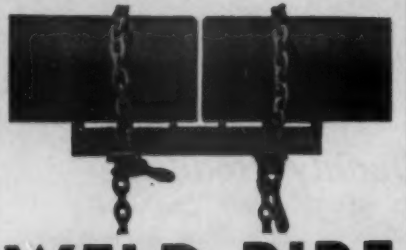

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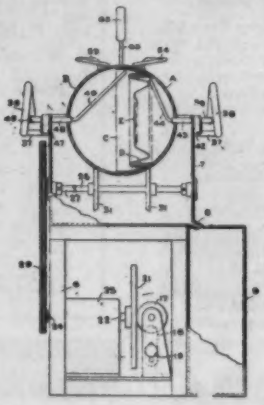
2,328,694. **Elias P. Townsley,** Chicago, assigned to **Hydraulic Controls, Inc.** Filed April 9, 1942. Issued Sept. 7, 1943.



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» «

Electrode Holder

2,328,067. **Valmore Forgett,** Teaneck, N. J., assigned to **Air Reduction Co., Inc.,** New York City. Filed Feb. 28, 1942. Issued Aug. 31, 1943.

An electrode holder including a body element threaded at one end and having a recess at the other, an insulated lead cable having a bare end portion permanently secured in the recess, a coil spring surrounding the insulation on the lead cable at a region back from the body element and a one-piece insulation jacket. The latter is molded over the body element, the forward end portion of the spring and the cable between the body and spring to hold spring in assembled relation with the other parts. The molded insulation is of large diameter in the region of the spring and recess to serve as a handle. At the forward end of the body element is a head with an opening for receiving a welding electrode. Insulation covers the head and overlaps the insulation on the body element, thus providing a fully-insulated electrode holder.

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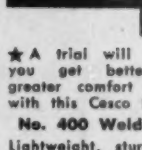

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